

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF INDIANA
SOUTH BEND DIVISION

RONALD SCHMUCKER, et al.,)	
)	
Plaintiffs,)	
)	
v.)	Case No. 3:14-cv-1593 JD
)	
JOHNSON CONTROLS, INC., et al.,)	
)	
Defendants.)	

OPINION AND ORDER

Johnson Controls, Inc. used to operate a manufacturing facility in Goshen, Indiana. Over the years, TCE and other chemicals were released into the ground at the facility. This contaminated the soil at the site and also created a plume of contaminated groundwater extending into an adjacent residential neighborhood. When the groundwater contamination was discovered off-site about thirty years ago, all of the homes nearby were connected to city waterlines to prevent exposure to contaminated water from private wells. About ten years ago, Johnson Controls learned that vapors from the contamination were entering the indoor air in some homes in the neighborhood, so vapor mitigation systems were installed in those homes. Not a single indoor air sample has exceeded the applicable screening level since. Johnson Controls regularly monitors the contamination under the supervision of the state agency and has undertaken several remediation activities, but contamination still exists both on- and off-site.

Five individuals who live in or own homes by the site filed this suit under the Resource Conservation and Recovery Act. They claimed that Johnson Controls was in violation of its obligations under that Act and that the contamination may present an endangerment to their health and the environment. The Court previously granted summary judgment on the “violation”

claim but held a bench trial on the “endangerment” claim. The Court now sets forth its findings of fact and conclusions of law on that claim.

For the reasons that follow, the Court finds in favor of Johnson Controls. Though contamination still exists on- and off-site, the Plaintiffs have not shown that the contamination may present an endangerment that is both imminent and substantial. The groundwater contamination does not pose a threat to the city wellfield, nor is there any non-speculative threat to drinking water through private wells or city waterlines. The contamination does not endanger the environment, either. As to vapor intrusion, any endangerment that may have existed has already been handled through the installation of vapor mitigation systems. Sampling data and other lines of evidence prove that those systems are successfully preventing any threat to health through exposure to vapors, just as they were meant to do, and just as they are counted on to do at many other sites.

The Plaintiffs express understandable frustration that contamination still exists in their neighborhood after all these years. Injunctive relief is only available on this claim when the contamination may present an imminent and substantial endangerment, though. Otherwise, the Act places responsibility on the state or federal agency to oversee remediation. The Indiana Department of Environmental Management is overseeing Johnson Controls’ ongoing remediation through its Voluntary Remediation Program. The Plaintiffs have submitted comments to the agency in response to Johnson Controls’ most recent remediation plan, and the agency is still evaluating that plan. But because the Plaintiffs have not proven that the contamination may present an imminent and substantial endangerment to health or the environment, no injunctive relief through the Act’s citizen-suit provision is warranted.

I. FINDINGS OF FACT

A. History of TCE Contamination

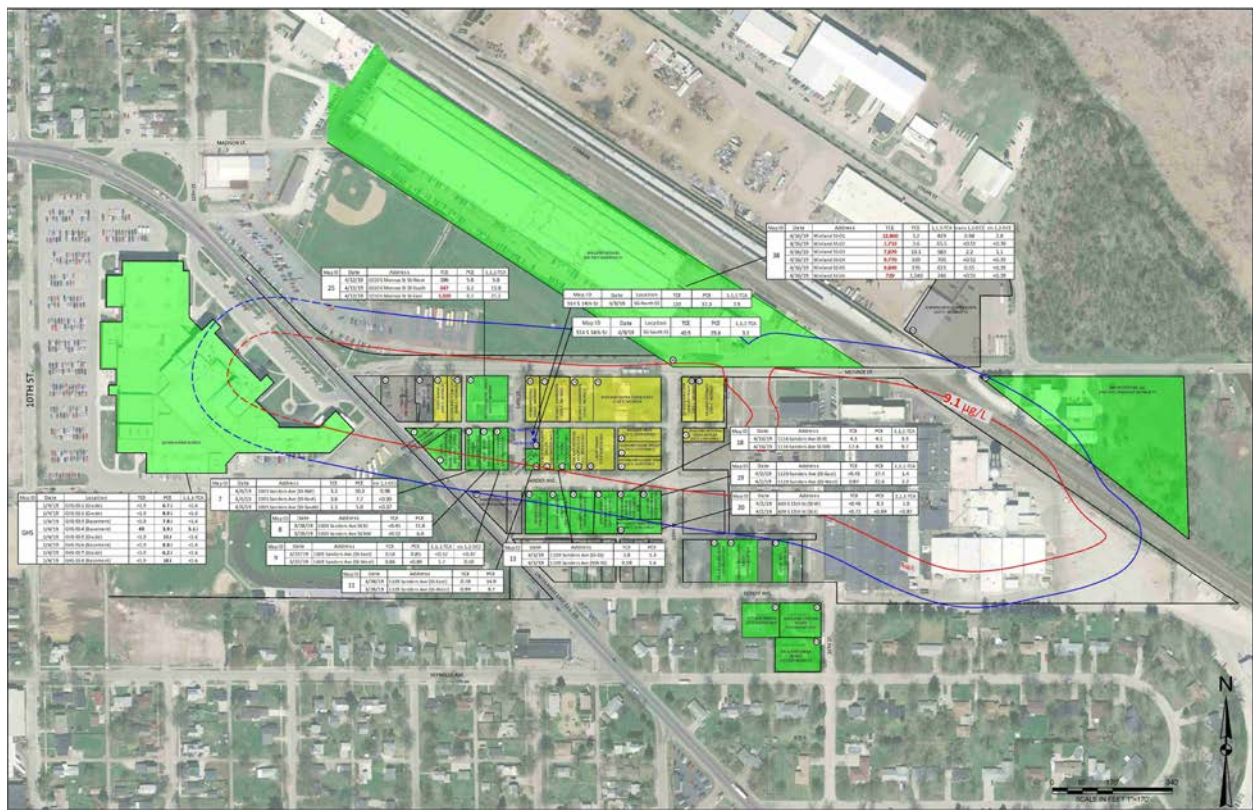
This case involves contamination by chlorinated volatile organic compounds (cVOCs). These compounds consist of an ethene molecule and a number of chlorine molecules. As the compounds degrade, they lose one chlorine molecule at a time, producing daughter products. Tetrachloroethylene, also known as perchloroethylene or PCE, is composed of four chlorine molecules. As PCE degrades and loses one chlorine molecule, it becomes trichloroethylene, or TCE. TCE is the primary contaminant in question here, and is the only one upon which the Plaintiffs' endangerment-to-health claim is based. TCE was commonly used in industrial settings as a degreaser. It is a known carcinogen and can also produce a variety of toxic effects. As TCE loses chlorine molecules, it becomes cis-1,2 dichloroethene (DCE) (two chlorines), and then vinyl chloride (one chlorine). Stripping away the last chlorine produces ethene, which is harmless.

From 1937 until 2006, Johnson Controls and its predecessor operated a manufacturing facility in Goshen, Indiana. During its operations at that facility, Johnson Controls manufactured control devices for measuring temperature, pressure, and liquid flow that were used in commercial heating, refrigeration, and environmental control systems. Certain of those manufacturing processes entailed the use of a vapor degreaser that used the solvent TCE, though Johnson Controls ceased using TCE at the site by 1998. Johnson Controls was a generator of hazardous waste under the Resource Conservation and Recovery Act, and it contributed to the handling, storage, treatment, transportation, or disposal of solid and hazardous waste.

After the passage of the Resource Conservation and Recovery Act, Johnson Controls elected to pursue closure of its waste management units instead of seeking a permit for the treatment, storage, and disposal of hazardous waste. In 1991, Johnson Controls conducted soil

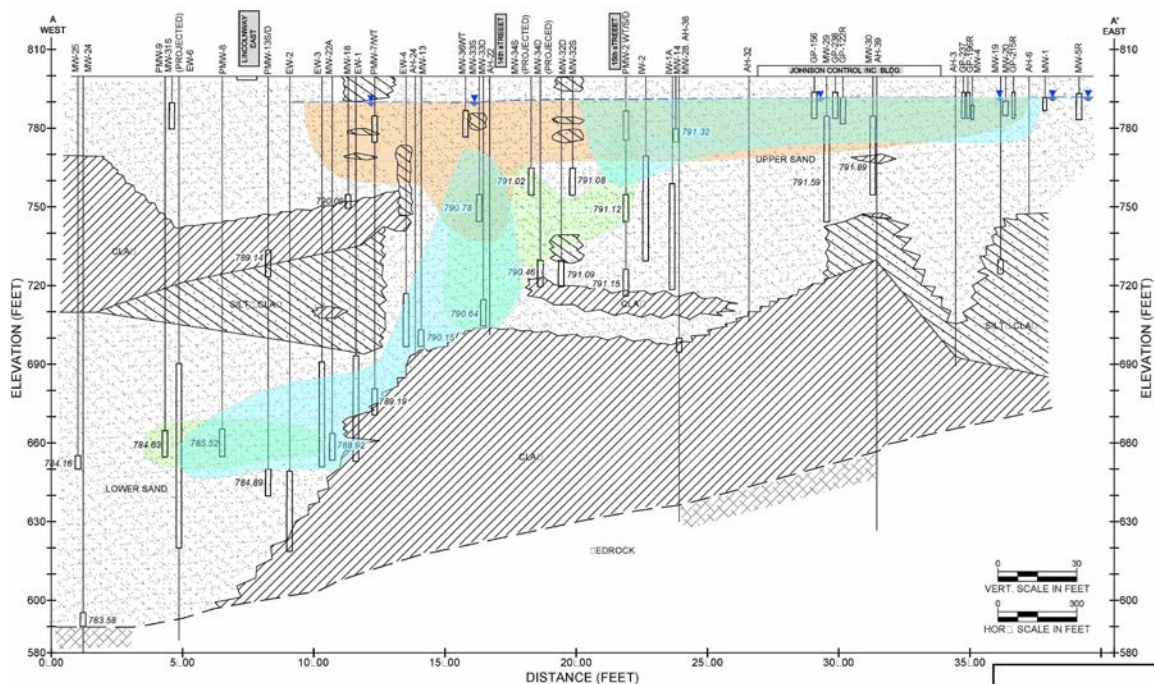
and groundwater sampling as part of its closure activities, and it discovered a large amount of TCE contamination in onsite soil and groundwater. Further investigation revealed a plume of contamination extending downgradient from the site, into a residential neighborhood. In early 1992, Johnson Controls identified homes in the vicinity of the site that might have private wells, and those homes were each connected to the municipal water supply to avoid exposure to contaminated groundwater.

The following figure is a more recent depiction of the scope of the plume of groundwater contamination:



site (at which the buildings have since been demolished, leaving only the building slab) is at the right side of that area. To the site's left is a neighborhood consisting primarily of residences, plus some commercial buildings. At the far left (west) end of the plume is Goshen High School. All of the homes in that area are connected to municipal water. Johnson Controls has also conducted follow-up investigations to confirm that all structures in that area and farther downgradient (to the west) past the high school receive city water bills and do not have private wells in use.

High levels of TCE contamination have consistently been detected in the soils at the site. Though no off-site soil contamination exists, the on-site soil contaminated the groundwater, which then carried the contamination into the neighborhood, as shown above. The water table in the area is about ten to fifteen feet below ground level. The groundwater contamination at the site is relatively shallow, but it becomes deeper as the groundwater carries the contamination off-site, into the neighborhood, leading to contamination in both the deep and shallow groundwater. The following figure depicts the underground geology and the areas of contamination across a cross-section of the plume:



[Jx. 1, app. B]. The TCE contamination (depicted in orange) mostly stays near the ground surface. As the contamination gets farther from the site, the contamination consists primarily of the degradation products of DCE (blue) and vinyl chloride (green), since the TCE naturally degrades over time.

When Johnson Controls discovered the groundwater contamination in the 1990s, it expressed concern that the contamination may reach one of the wellfields from which the City of Goshen draws its drinking water, as the site is located about a mile southeast of the North Wellfield. In 1997, however, the City of Goshen had a wellhead protection report prepared, as required by the Safe Drinking Water Act. That report, prepared by Peerless, determined that the groundwater in the area of the wellfield generally flows from the northeast, and that the wellfield primarily draws its water from that direction. The report estimated the area from which the wellfield draws water over one-year and five-year periods. The Johnson Controls site, which is to the southeast of the wellfield, was not within either of those capture zones, and the site was not identified as a potential source of contamination for the wellfield. [Dx. V-2]. The Peerless report has been periodically reviewed since it was issued, and has not materially changed. [Dx. L-4].

In 2011, Johnson Controls also began to investigate the possibility of vapor intrusion by TCE. In a typical vapor intrusion pathway, contamination in the shallow groundwater volatilizes into vapors.² The vapors then rise through the soil towards the surface. When those vapors encounter a structure, they can enter the structure through cracks or other openings, and can thus cause indoor air to be contaminated. The vapors can also infiltrate sewer lines or other preferential pathways and travel to and enter a structure through those avenues. Johnson Controls

² As explained below, the Court does not find that the neighborhood is at risk of vapor intrusion through lateral diffusion of vapors through the soil from the site into the neighborhood.

had previously believed that the off-site contamination was only in the deeper groundwater, which does not present a risk of vapor intrusion. Johnson Controls discovered, however, that the shallow groundwater was contaminated as well, so it tested the subslab vapor levels and then followed up with indoor air tests.

Many of the subslab tests revealed vapors far in excess of the regulatory screening level, and fifteen homes had tests exceed the then-applicable screening level in their indoor air or crawlspace. All fifteen of those homes (depicted in yellow in the figure on page 4) had vapor mitigation systems installed.³ Vapor mitigation systems, which are commonly used for radon, draw air from below the slab and vent it to the outside air. By creating depressurized conditions below the slab, they inhibit vapors from entering the structures. Vapor mitigation systems are considered the presumptive remedy for vapor intrusion, and they are used for that purpose at many sites.

The mitigated homes have all had multiple rounds of testing conducted since the systems were installed. Several of the homes have not had any TCE detected at all since then. Though TCE has been detected in other homes, any detections have been at much lower levels, and no indoor air test has exceeded the agency screening levels since the systems' installation. In structures without mitigation systems, no indoor air test has ever exceeded the applicable screening level. Indoor air at Goshen High School has been tested as well, and no TCE has ever been detected in those tests.

Subslab vapors in the neighborhood have reduced substantially since 2011, too. Though the homes with mitigation systems have not had the subslab vapors tested again (as indoor air tests in those homes confirm no vapor intrusion above screening levels), other homes have had

³ The homes with crawlspaces had crawlspace ventilation systems installed in those areas.

the subslab vapors tested, and none of those tests have exceeded the subslab screening level since 2011. Some commercial structures have had subslab vapors exceed the screening level in recent tests, though, including the Interra Credit Union, which is in the neighborhood, and the Weiland property, which is across the street from and side-gradient to the neighborhood. No indoor air test in those structures has exceeded the screening level, however. TCE vapors have also been detected in two sewer lines in the area, but as already noted, no TCE has been detected above screening levels in any structure since 2011. TCE continues to be detected above the applicable screening levels in the shallow groundwater in the plume, though.⁴

B. Remedial Activities

Since 1996, Johnson Controls has participated in Indiana's Voluntary Remediation Program, and it has conducted a number of remedial activities under the supervision of the Indiana Department of Environmental Management (IDEM). Johnson Controls operated a "pump and treat" system from 1994 to 2012. This system pumped contaminated groundwater from the ground, treated it, and then discharged the treated groundwater. Over the course of its operation, this system removed about 11,000 pounds of contaminants, including over 6,000 pounds of TCE. Eventually, however, some of the pumping wells were no longer producing any contaminants, and others reached a plateau at lower concentrations, so Johnson Controls shut the system down with IDEM's approval.

⁴ Dr. Keramida opined that the soil and groundwater screening levels represent levels above which unacceptable vapors are "likely" to result. [*E.g.*, 425-1 ¶¶ 41, 42]. To the contrary, the screening levels are conservative and are based on the 95th percentile of attenuation rates. [Tr. 573]. Thus, the screening levels actually represent levels at which producing that effect is unlikely. [Tr. 577-79 ("[Screening levels] are upper-bound levels. So most buildings would be -- 95 percent at least would be expected to show greater attenuation."); Jx. 9 p. 16 ("Because of the protective assumptions incorporated into screening levels, IDEM expects that site-specific levels will nearly always exceed screening levels.")].

Johnson Controls has also conducted some targeted remediation of the soils at the site. In 2015, it applied a soil treatment (emulsified zero valent iron) in two areas of very highly elevated TCE contamination. This treatment involved mixing iron and vegetable oil into the soil to promote the TCE's breakdown into innocuous end products. After six months, the concentrations of TCE in those two areas had been reduced by about 95 percent. Elevated concentrations of TCE in the soil still exist at many areas across the site, though.

Most recently, Johnson Controls injected Enhanced Reductive Dechlorination treatment walls to treat the shallow groundwater. This treatment strategy involves injecting bacteria and vegetable oil to the subsurface in order to breakdown the TCE. The vegetable oil produces anaerobic conditions, which allow the bacteria to remove chlorines from the TCE, ultimately producing an innocuous gas. Johnson Controls began by injecting a pilot treatment wall over the core of the plume along the site's western border, nearest to the neighborhood. That portion of the treatment wall is now mature and has been highly effective. In the immediate area of the treatment wall, TCE has been reduced by 99 percent, to even within acceptable levels for drinking water. Other data shows that the treatment wall is functioning well, including large increases in ethene, the non-toxic end-product.

The treatment zone has begun to extend downgradient into the neighborhood, as well. The effects off-site have not yet been as pronounced, and it is still uncertain how far downgradient the treatment zone will extend. Even if the treatment zone does not degrade the TCE throughout the plume, however, it can still be expected to have beneficial effects downgradient. First, by treating the groundwater at the site's boundary, the treatment wall will prevent any further loading of contamination from the site, where the soil and groundwater contamination remains elevated. And relatedly, because the groundwater that flows into the

neighborhood will be free of TCE, the concentrations of TCE in the neighborhood should gradually reduce through the process of attenuation.

After initial tests proved the pilot wall effective, Johnson Controls extended the western wall across the length of the site. It also installed two other treatment walls, one near the middle of the site and the other towards the eastern edge. Preliminary data reflect that those treatment walls are progressing, but they have not yet reached full maturity, as treatment walls generally take about a year to mature and only about six months of data are available.

Johnson Controls has submitted a Revised Remediation Work Plan for IDEM's approval as part of the Voluntary Remediation Program. That plan proposes to remediate the shallow groundwater through the treatment walls just discussed, which have already been injected. Johnson Controls proposes to continue monitoring those treatment walls and to make further injections as appropriate. Johnson Controls further proposes to remove the building slab and pavement at the site and to remove or remediate any soil at the site that exceeds the direct-contact screening level for TCE. Johnson Controls intends to continue to operate and maintain the vapor mitigation systems in the neighborhood until the groundwater in the neighborhood has been sufficiently remediated.

After Johnson Controls submitted its work plan, IDEM received public comments from the Plaintiffs' counsel. IDEM then required Johnson Controls to make revisions to the plan, which Johnson Controls did. IDEM then accepted another round of comments and held a public hearing at which the Plaintiffs' counsel and various residents spoke. IDEM has not yet granted formal approval for the plan. The Voluntary Remediation Program in which Johnson Controls is participating does not have enforcement power. However, if IDEM determined that the site posed an endangerment, or that Johnson Controls was not acting in good faith or not acting in a

timely manner, it could terminate Johnson Controls from the Voluntary Remediation Program and commence an enforcement action.

C. This Suit

The Plaintiffs in this suit own or live in three properties in the neighborhood over the plume. Mr. Stewart's home abuts the Johnson Controls site, and the VanDiepenbos and Schmucker homes are immediately to its west. Each of those homes had TCE vapors detected in their indoor air in 2011, so they each have vapor mitigation systems. The Plaintiffs filed this action under the Resource Conservation and Recovery Act against Johnson Controls and Tocon Holdings, LLC. (Tocon has owned the site since 2007, but has not participated in this action and is in default). They asserted claims under both of the Act's citizen-suit provisions. First, they asserted that Johnson Controls is in violation of its obligations under the Act, under 42 U.S.C. § 6972(a)(1)(A). Second, they asserted that the contamination may present an imminent and substantial endangerment to health or the environment, under 42 U.S.C. § 6972(a)(1)(B). They seek injunctive relief requiring Johnson Controls to remediate the soil at the site, and the shallow and deep groundwater both on- and off-site.

The Court previously granted summary judgment for Johnson Controls on the "violation" claim but denied cross-motions for summary judgment on the "endangerment" claim. The Court thus held a bench trial over seven days, after which it accepted post-trial filings. The matter is now ripe for ruling.

II. PRELIMINARY MOTIONS

Before proceeding to the substance of the Plaintiffs' claims, the Court notes that Johnson Controls filed several motions to strike testimony by the Plaintiffs' experts, Dr. Keramida and Dr. Orris. Johnson Controls first argues that the experts' written testimony exceeded the scope of their expert reports. Johnson Controls also objected at trial to various testimony and exhibits on

that basis, and the Court took those objections under advisement. The Court declines to strike any testimony on this ground. Many of the statements at issue were adequately disclosed in the expert reports. And to the extent any statements impermissibly stray beyond the expert reports, those statements would not affect the outcome. Accordingly, the Court denies the first two motions to strike and overrules the objections on this ground.⁵

Johnson Controls also moved to strike the experts' opinions under Rule 702. The Court declines to resolve these motions on their substance. As explained in detail below in discussing the claims on their merits, the Court does not place weight on the challenged testimony even assuming it is admissible. Because the Court does not credit the testimony (or has decided that it does not affect the outcome), the Court need not determine whether the testimony falls short of Rule 702 as well. For example, Johnson Controls challenges Dr. Keramida's opinion that the contamination is at risk of reaching the wellfield. As discussed below, Johnson Controls' criticisms in that respect are mostly well-taken, and the Court is more persuaded by Johnson Controls' expert and other evidence. *See LAJIM, LLC v. Gen'l Elec. Co.*, 917 F.3d 933, 946 (7th Cir. 2019) ("In a case of dueling experts, . . . it is left to the trier of fact . . . to decide how to weigh the competing expert testimony."). Whether or not Dr. Keramida's opinion satisfies Rule 702 would not change the weight the Court gives to it, so the Court need not strike the opinion. The same goes for the other opinions at issue. The Court therefore denies these motions to strike as moot.

⁵ Some of the exhibits Johnson Controls objected to in its post-trial submission were exhibits it explicitly said at trial it had no objection to and that were thus admitted without objection (Exhibits Px. 63, 64, 81, and 87). Those objections are waived.

III. CONCLUSIONS OF LAW⁶

The Plaintiffs seek injunctive relief under the Resource Conservation and Recovery Act, which provides a civil action “against any person . . . who has contributed . . . to the past or present handling, storage, treatment, transportation, or disposal of any solid or hazardous waste which may present an imminent and substantial endangerment to health or the environment.” 42 U.S.C. § 6972(a)(1)(B). When that standard is met, a court may restrain the person or “order such person to take such other action as may be necessary” to eliminate that danger. *Id.* § 6972(a); *LAJIM*, 917 F.3d at 949.

An endangerment claim has three elements: (1) that the defendant has generated solid or hazardous waste; (2) that the defendant is contributing or has contributed to the handling of this waste; and (3) that this waste may present an imminent and substantial endangerment to health or the environment. *Liebhart v. SPX Corp.*, 917 F.3d 952, 958 (7th Cir. 2019); *LAJIM*, 917 F.3d at 941. The parties agree that the first two elements are met. [DE 421, 394, 390]. The only disputed element is whether the contamination “may present an imminent and substantial endangerment to health or the environment.” The parties also dispute what, if any, injunctive relief should be imposed should the Plaintiffs prevail on that issue.

Several of those terms warrant further explanation. First, the term “endangerment” means “a threatened or potential harm and does not require proof of actual harm.” *Simsbury-Avon Pres. Club, Inc. v. Metacon Gun Club, Inc.*, 575 F.3d 199, 211 (2d Cir. 2009). The statute requires that the contamination “may present” such an endangerment. 42 U.S.C. § 6972(a)(1)(B). This wording has been construed as “expansive” and as meant “to confer upon courts the authority to grant affirmative equitable relief to the extent necessary to eliminate any risks posed by toxic

⁶ This section notes further findings of fact where pertinent.

waste.” *Maine People’s Alliance & Nat. Res. Def. Council. v. Mallinckrodt, Inc.*, 471 F.3d 277, 287 (1st Cir. 2006); *see also Liebhart*, 917 F.3d at 958. The combination of these two probabilistic terms means that plaintiffs need only demonstrate “a reasonable prospect of future harm,” “so long as the threat is near-term and involves potentially serious harm.” *Mallinckrodt*, 471 F.3d at 296. At the same time, “there is a limit to how far the tentativeness of the word may can carry a plaintiff”; “there is no endangerment unless the present or imminent situation can be shown to present a risk of (later) harm.” *Crandall v. City & Cty. of Denver, Colo.*, 594 F.3d 1231, 1238 (10th Cir. 2010); *see also Avondale Fed. Sav. Bank v. Amoco Oil Co.*, 170 F.3d 692, 695 (7th Cir. 1999).

The endangerment must also be both “imminent” and “substantial.” An endangerment is “imminent” if it “threatens to occur immediately.” *Meghrig v. KFC Western, Inc.*, 516 U.S. 479, 486 (1996). “[T]here must be a threat which is present *now*, although the impact of the threat may not be felt until later.” *Id.*; *Burlington N. & Santa Fe Ry. Co. v. Grant*, 505 F.3d 1013, 1021 (10th Cir. 2007) (“An ‘imminent hazard’ may be declared at any point in a chain of events which may ultimately result in harm to the public.” (internal alteration and quotation omitted)); *Albany Bank & Tr. Co. v. Exxon Mobil Corp.*, 310 F.3d 969, 972 (7th Cir. 2002) (“Imminence does not require an existing harm, only an ongoing threat of future harm.”). Endangerments that existed only in the past do not qualify. *Meghrig*, 516 U.S. at 486. Finally, an endangerment is “substantial” if it is “serious.” *Grant*, 505 F.3d at 1021. “This does not necessitate quantification of the endangerment, as an endangerment is substantial where there is a reasonable cause for concern that someone or something may be exposed to risk of harm by release, or threatened release, of hazardous substances in the event remedial action is not taken.” *Id.*; *see also Liebhart*, 917 F.3d at 959 (holding that RCRA “requires that [plaintiffs] show that contaminants on the

property are seriously dangerous to human health (or will be, given prolonged exposure over time)").

The Plaintiffs contend that the contamination here may present an imminent and substantial endangerment in multiple respects and through various means of exposure. They argue that the groundwater contamination may present an endangerment to health through various potential routes of exposure and that it may also present an endangerment to the environment. The primary emphasis of their claim, though, is that the contamination may present an endangerment to health through the threat of vapor intrusion into indoor air in the neighborhood.

A. Groundwater

The Court begins with the Plaintiffs' arguments about groundwater. The Plaintiffs argue that the groundwater contamination may present an endangerment to health through multiple avenues: the City's wellfield, private wells, and waterlines. They also argue that the contamination in the soil and groundwater may present an endangerment to the environment. The Court addresses each theory in turn.

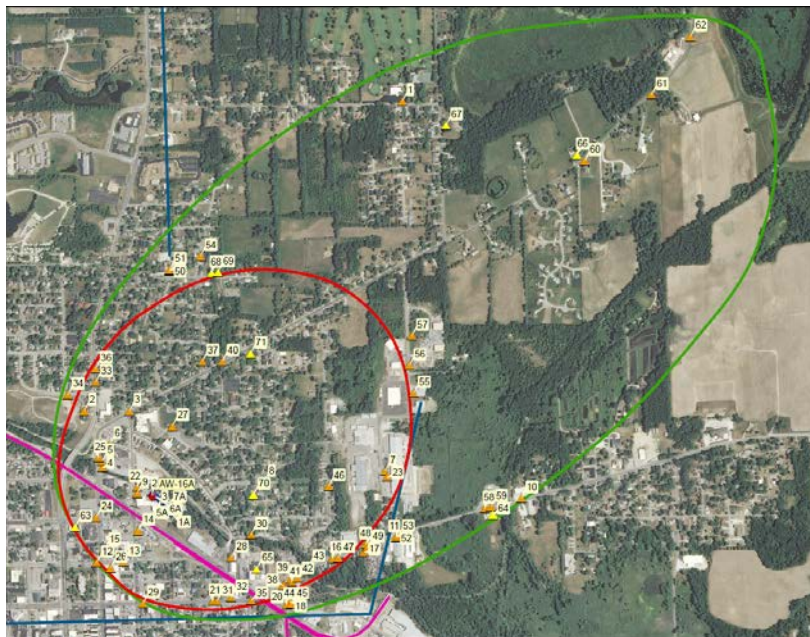
1. Wellfield

First, the Plaintiffs argue that the contamination may present an imminent and substantial endangerment to health because of the risk that it will reach a wellfield from which the City of Goshen draws its drinking water. The Court does not find that the contamination may present an endangerment in this respect, though, as the Plaintiffs have not shown that there is any realistic threat that the contamination will ever reach the wellfield. To the contrary, the evidence establishes that the contamination is not at risk of reaching the wellfield.

Both sides have presented expert testimony on whether the contamination threatens to reach the wellfield. Of the evidence on this issue, however, the Court is most persuaded by the

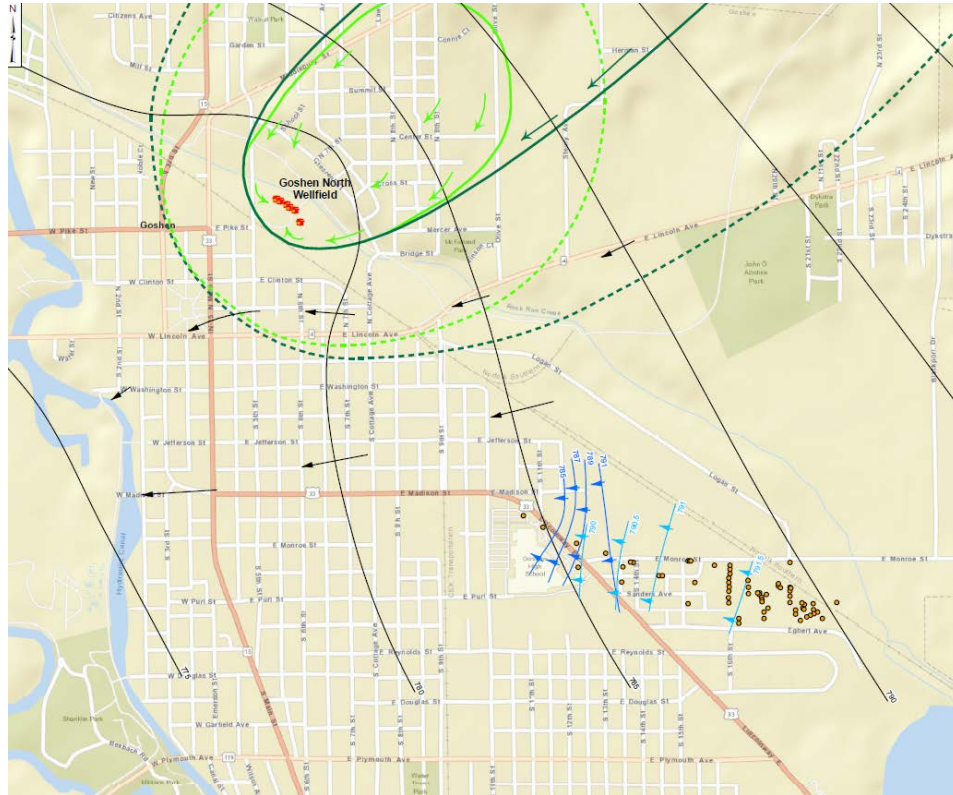
Peerless report, which was commissioned by the City of Goshen in order to manage its wellfields. The Peerless report was first issued in 1997, and has been evaluated and updated over the years, most recently in 2017. [Jx. 65 p. 8; Dx. V-2; Dx. L-4]. The Peerless report is not a made-for-litigation report, and the City of Goshen actually relies on the report to manage and protect its wellfields, so the Court gives it substantial weight.

The Peerless report evaluated the one-year (shown in red) and five-year (green) capture zones for the wellfield and identified each of the potential sources of contamination in those areas, as shown here:



[Dx L-4, fig. 2]. Neither the Johnson Controls site nor the area into which contamination has migrated are within those areas—they are below the area depicted in that figure—and the Peerless report does not identify that site as a potential source of contamination for the wellfield. The Peerless report is also very conservative, as it is based on pumping rates that far exceed the actual pumping rates, meaning the wellfield actually draws from a smaller area.

The report reflects several other notable points, too, as testified to by Dr. Zeeb, Johnson Controls' hydrogeologist. The figure below, prepared by Dr. Zeeb, includes the Peerless report's capture zones (in dashed lines), the capture zones based on the Peerless model but using the actual pumping rates (in solid lines), and the Johnson Controls site and affected area (in the lower right, in the area of the orange dots, which reflect monitoring wells).



[Dx 65, fig. 4-3]. The solid black lines show areas of equal elevation of the groundwater (equipotential lines), with the black arrows pointing perpendicular to those lines, approximating the direction of groundwater flow. [Tr. 876–77]. The blue lines and arrows in the area of the site reflect the elevations and flow direction of the groundwater based on measurements taken in those specific areas.

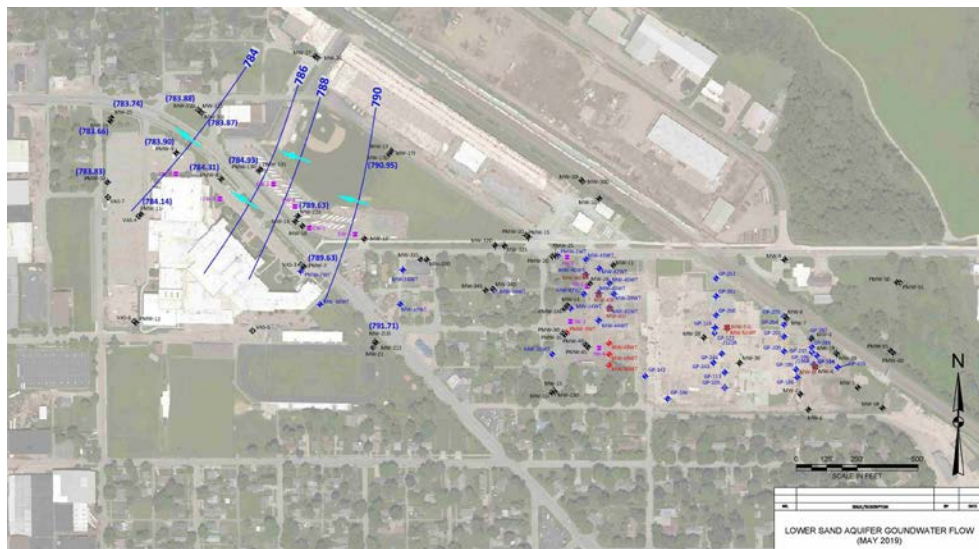
This analysis shows that the wellfield draws water predominantly from the northeast, which is the direction from which groundwater flows in the area. The Johnson Controls site and

related contamination are to the southeast, though, and are not in the capture zone. In addition, in the direction of the site, the borders of the one-year and five-year capture zones are almost the same. In fact, when using the actual pumping rates (shown in solid lines), the one-year (light green) and five-year (dark green) capture zones are nearly identical in that area. That demonstrates that water simply does not flow towards the wellfield from that direction. It also shows, as Dr. Zeeb testified, that using a longer time-horizon would make no difference. Extending the time of travel to ten years or beyond would only extend the capture zone farther to the northeast, from where the groundwater flows; it would not extend the capture zone toward the Johnson Controls site. [*E.g.*, Tr. 885 (“If you pump any longer or if you allow more travel time, the only thing that happens is the capture zone lengthens to the northeast from where the water is coming.”)].

While this analysis also reflects that the groundwater is at a slightly lower elevation at the wellfield than in the area of the contamination, that does not suggest that the contamination is flowing towards or may reach the wellfield. Groundwater tends to flow from areas of higher elevation to lower elevation. But more specifically, it tends to travel in the direction of the maximum gradient—in the direction of the steepest slope. [*E.g.*, Tr. 876–77 (“And the reason groundwater flows perpendicular to the equipotential lines [reflecting equal elevations] is that’s the direction in which the water is most steeply tilted.”), 1015 (“Water flows perpendicular to equipotentials, all other things being equal. But that doesn’t mean it flows from every point of higher elevation to every point of lower elevation.”)]. Here, the steepest gradient is generally to the west or southwest, not to the northwest. For the same reason, the straight-line proximity to the wellfield does not suggest that the wellfield is at risk, as the groundwater is not moving in that direction. Thus, it is not accurate to say that the contamination may reach the wellfield

because the wellfield is slightly lower than the contamination, or because the contamination is only a given distance away from the capture zone, or because they are in the same aquifer. [See Tr. 892].

In arguing to the contrary, the Plaintiffs and Dr. Keramida rely in large part on water-level elevations taken from monitoring wells in the immediate area of the contamination, which show the groundwater gradient pointing toward the northwest, such as shown in the following figure:



[Jx 2, fig. 4]. This argument assumes, however, that the groundwater continues flowing in that same direction (and turns even farther north) all the way to the wellfield's capture zone. Dr. Keramida offers no analysis to support that assumption, and as already discussed, the Peerless report and Dr. Zeeb's analysis provide convincing evidence that it does not.

As Dr. Zeeb testified, the Peerless report was calibrated most carefully in the area of the capture zone, but the contamination here is away from that zone, at the fringe of the modeled area. Minor discrepancies at the fringe of that area do not show that the model is inaccurate in the area of the wellfield. [Tr. 881–82 (“What we’re looking at in this Peerless line is the edge of a model. The center portion of that model [closest to the wellhead] has been carefully calibrated

to get reliable answers with respect to the wellhead protection area. The edges of the model are going to match generally but not precisely.”); DE 424-2 (“[O]n a small scale, groundwater flows partially towards the northwest in the immediate area of the Site, particularly in the shallow aquifer. But the dominant hydraulic gradient in this area is west[.]”). Even then, the Peerless report is still roughly consistent with the actual measurements taken in the area of the contamination, showing that the Peerless report reliably reflects the groundwater flow and the capture zones for the wellfield. [Tr. 881 (“[The equipotential lines are] roughly in the same place. You would never expect any better agreement than this.”)].

Of course, the model is not perfect. Actual elevations may differ slightly from the model, subsurface conditions can affect the flow direction, and groundwater flow can vary over time, too. [*E.g.*, Tr. 879, 886–87, 959–60, 1002]. The possibility of variations in the groundwater flow does not suggest that the contamination may pose an endangerment to the wellfield, though. As already noted, the Peerless model assumed a pumping rate far higher than the actual pumping rates (about three times the actual rates), but even with that exceedingly conservative assumption, the contamination still falls outside of the capture zones.⁷ The actual pumping rates (which the evidence offers no indication may increase) show that the contamination is even farther from the wellfield. [*See also* DE 424-2 ¶ 6 (“[N]ot only are the simulated capture zones significantly larger than the capture zones at actual pumping rates . . . , but the capture zones are also conservatively drawn vis-à-vis any theoretical contaminant impact because contaminants generally travel at less than the velocity of water.”)]. Given those conservatisms, the possibility

⁷ *See* Tr. 885–86 (“Under worst-case pumping conditions, three times more than they have pumped in the last decade, we know from the Peerless model that to an approximation -- it’s not perfect, it’s a model -- groundwater flows along this line, this dashed line[.] . . . Is that line a magical physical line? No, it’s not. It’s a modeled line, but it’s the best model that we have.”).

of variations over time or of localized variations in particular areas does not present a risk that the contamination may reach the wellfield.

The other evidence the Plaintiffs cite is unpersuasive. For example, the Plaintiffs cite a decades-old statement by Johnson Controls' then-contractor indicating that the contamination was moving towards the wellfield. That statement was from 1997, though, before the Peerless report was issued. The Plaintiffs have not shown what evidence that statement was based on, either, or attempted to engage with those materials to show that they support that conclusion. Given the age of that statement and all of the evidence over the intervening years, the Court cannot place any weight on that statement or other similar, dated statements. The Plaintiffs also argue that the purpose of the former pump-and-treat system was to protect the wellfield, such that the wellfield is at risk now that the system has been shut down. The parties dispute whether Johnson Controls in fact operated the system for that purpose. Regardless, speculating about Johnson Controls' motives years ago when it installed and operated the system, and extrapolating from there whether the wellfield is currently at risk, offers little support for the Plaintiffs' position, particularly in light of the more recent evidence and analysis already discussed.

Finally, even if there was some possibility that some amount of contamination might someday reach the wellfield, the Plaintiffs have failed to offer any basis upon which to find that the endangerment would be substantial. Unless the level of contamination would be significant enough to pose a risk to health (or impair the City's ability to use the wellfield, as might present an endangerment to the environment, as discussed below), it would not pose an "imminent and substantial" endangerment. The Plaintiffs have offered no evidence about what amount of contamination may reach the wellfield if it even traveled in that direction, or what level of contamination may result in the drinking water should that occur—whether it would even be a

detectable amount in the millions of gallons of water pumped per day. That's not to say the Plaintiffs have to quantify the endangerment, and the legal standard may tolerate a degree of uncertainty, *Interfaith*, 399 F.3d at 260, but there still has to be some basis on which to "assess the magnitude of the possible risk," *Metacon*, 575 F.3d at 211–12. Without any basis to evaluate the significance of the endangerment that might result if the contamination should ever reach the wellfield, the Court cannot find that the contamination may present an imminent and substantial endangerment if that happened.

For those reasons, the Court cannot find that the contamination may present an imminent and substantial endangerment to health through the risk that it may reach the wellfield. The most reliable evidence and testimony establishes that the contamination does not pose a threat of reaching the wellfield, and the Plaintiffs have not shown what sort of endangerment may occur even if some amount of contamination flowed in that direction. The Plaintiffs thus cannot sustain their endangerment claim on this basis.

2. Private Wells

The Plaintiffs also argue that residents in the neighborhood may be using private wells that draw drinking water from contaminated groundwater. Simply put, this claim is far too speculative to sustain a finding that the contamination may present an imminent and substantial endangerment. Over 25 years ago, all the structures in the vicinity of the contamination were connected to City water. Johnson Controls has also conducted multiple investigations over the years to verify that no private wells are still in use in the area. [*E.g.*, Jx. 49, ex. 9; Tr. 389–91]. It has confirmed that all the properties over the plume of contamination receive water bills. A Goshen ordinance also prohibits new wells and requires any old wells in the area to be abandoned. And while Goshen High School has two irrigation wells, they are not over the plume and have not had TCE detected. [Tr. 391]. Dr. Keramida suggests in passing that some homes

still have wells, [*e.g.*, DE 425-1 ¶ 50], but she gives no reason to believe that any such wells may be in use now or in the future, much less for drinking water.⁸ [*See* Tr. 147 (“Q. And those homes where you saw an old well not being used, those houses were on city water, correct? A. Yes, they are.”)]. Tellingly, the Plaintiffs did not even mention this theory in their closing argument or post-trial brief.

If there is no realistic, non-speculative risk that anyone is (or will be) drinking water from private wells in the area, then the groundwater contamination does not present an imminent and substantial endangerment to health by that route of exposure. *See Liebhart*, 917 F.3d at 960 (“That is not to say that all the plaintiffs must do is to show some bit of soil on their property that tests positive for [contaminants]. . . . Of course, there must be accompanying evidence that establishes some connection between the existing contaminants and some imminent and substantial endangerment to health.”); *Avondale Fed. Sav. Bank v. Amoco Oil Co.*, 170 F.3d 692, 695 (7th Cir. 1999) (holding that existing contamination did not pose an endangerment absent a threat of exposure); *Miller v. City of Fort Myers*, 424 F. Supp. 3d 1136, 1147–49 (M.D. Fla. 2020) (rejecting an endangerment claim where the plaintiff offered only speculation that anyone may have been drinking from contaminated wells, and collecting cases reaching the same conclusion absent evidence that people may be drinking contaminated water). Given all the precautions that have already been taken, the possibility that some unknown person may use a private well within the area of the contamination is far too remote and speculative to qualify as an imminent and substantial endangerment. Thus, the Court cannot find that the Plaintiffs have

⁸ The Plaintiffs have offered no basis on which to evaluate whether the contamination may pose an imminent and substantial endangerment through any other route of exposure, such as if the water was used for irrigation; Dr. Orris confined his opinions to the risks from vapor inhalation, and the maximum contaminant levels the Plaintiffs cite apply to drinking water.

met their burden of showing that the contamination may present such an endangerment in this respect, either.

3. Water Pipes

The Plaintiffs similarly argue that the contamination poses a risk of infiltrating the drinking water pipes that run through the neighborhood, and may present an imminent and substantial endangerment to health by contaminating drinking water in that manner. Again, however, the Plaintiffs' evidence is far too thin and speculative for the Court to find any realistic risk that the contamination may infiltrate waterlines.

As Dr. Zeeb testified, the concentrations at which contamination poses a risk of infiltrating waterlines are multiple orders of magnitude higher than the concentrations at issue here. [Tr. 893–96; Jx. 65 p. 11–12; Jx. 66 p. 7; DE 424-2 ¶ 4]. Dr. Keramida opined that the waterlines were nonetheless at risk, but she did not bring her expertise to bear in forming that opinion. To the contrary, she relied primarily on an article in the local newspaper about a water main replacement project by the City of Goshen. [Jx. 50]. The article notes that, as part of the project, Goshen decided to use upgraded gaskets to protect against TCE contaminating the waterlines, an upgrade for which Johnson Controls agreed to pay. Dr. Keramida's report did not offer any analysis of her own as to whether conditions in the area actually posed a risk of infiltrating the waterlines.⁹ Her report cited an EPA study on permeation or leaching into pipes, but as Dr. Zeeb testified, that report and its supporting materials indicated that the risk was present only at levels much, much higher than those found here.

⁹ Johnson Controls' contractor also wrote in a letter to the City that "consideration should be given to selecting both waterline piping and gasket materials that will remain resistant to long-term degradation or permeation by residual chemical solvents such as TCE." [Px. 265 p. 4]. That mild caution is a far cry from indicating that the contamination may present an imminent and substantial endangerment by permeation of waterlines.

In addition, neither Dr. Keramida nor the Plaintiffs have conducted any tests to confirm their theory that contamination may be infiltrating the waterlines. If the contamination posed a threat of infiltrating the waterlines, the Plaintiffs offer no reason to believe it would not have done so already. Yet they never took any water samples from their homes (or any other homes) to determine whether any TCE was present in the water.¹⁰ Not only does that leave them with an evidentiary deficit, it undercuts the credibility of this argument. If Dr. Keramida or the Plaintiffs believed there was any risk to their water, they could have easily conducted a test to protect their own safety, but they have not done so. And again, even if there was some risk that TCE might infiltrate the water lines, the Plaintiffs have offered no evidence that it may do so in amounts significant enough to pose any risk to their health. Thus, the Court cannot find that the contamination may present an imminent and substantial endangerment to health in this respect either.

4. Threat to the Environment

The Plaintiffs further argue that, apart from any endangerment to health, the contamination's presence in the ground means that it may present an imminent and substantial endangerment to the environment. This theory is a narrow one; the Plaintiffs expressly withdrew any claim that the contamination may present an endangerment to any ecological receptors (like plants, wildlife, or organisms).¹¹ [DE 417 p. 52]. The theory is thus that the contamination may

¹⁰ The following exchange with Dr. Keramida sums up the holes in the Plaintiffs' evidence on this issue: "Q. You're not aware of any such contamination entering the waterlines, correct? A. I have not seen data to show that the drinking water in those lines is impacted by TCE. Q. And you've conducted no testing of any of the drinking water inside of any of these homes in the neighborhood, correct? A. That's correct. Q. And nowhere in your report do you analyze the level of TCE contamination that would be required to penetrate the city waterlines, correct? A. That's correct." [Tr. 147].

¹¹ Johnson Controls argues that the Plaintiffs withdrew the entirety of their endangerment-to-the-environment argument by withdrawing any argument as to ecological receptors. The Court disagrees. The argument that remains is narrow, but the Plaintiffs did not withdraw their

present an endangerment to the environment through its presence in the soil and groundwater, even absent any secondary effects.

The Court cannot find an endangerment in this respect. As discussed at summary judgment, contamination's presence alone does not equate to an imminent and substantial endangerment to the environment. RCRA "is not a 'cleanup' statute." *LAJIM*, 917 F.3d at 949; see *Meghrig*, 516 U.S. at 483. An endangerment claim requires a "risk of harm," *Liebhart*, 917 F.3d at 958, and authorizes injunctive relief only as "necessary to prevent harm[.]" *LAJIM*, 917 F.3d at 949. A substance that is present in the environment but threatens no harm does not pose an imminent and substantial endangerment to the environment. See *Grant*, 505 F.3d at 1021 ("[A]n endangerment is substantial where there is reasonable cause for concern that someone *or something* may be exposed to risk of harm . . . in the event remedial action is not taken." (emphasis added)).¹² It may well be desirable for nature to remain in a pristine condition, but an endangerment claim requires some threatened or potential effect beyond the fact that a substance is present belowground that is not naturally occurring. *Miller*, 424 F. Supp. 3d at 1146–47 ("The mere presence of contamination is alone not enough to constitute an imminent and substantial endangerment. This is true even for groundwater—the simple existence of contaminated groundwater does not automatically impel an endangerment claim." (internal quotations and citations omitted)); *Tri-Realty Co. v. Ursinus College*, 124 F. Supp. 3d 418, 454 (E.D. Pa. 2015) ("To hold that any amount of pollution that impairs the purity or natural state of some element of

argument that the contamination's presence in the soil and groundwater may present an endangerment, and Johnson Controls had an opportunity to address that argument at trial.

¹² See also *LAJIM*, 917 F.3d at 949 ("We sympathize with plaintiffs' position—TCE is a dangerous contaminant and the current plan leaves the contamination in place (though contained and restricted from access). But, despite plaintiffs' characterization, the RCRA is not a 'cleanup' statute. . . . The RCRA does not require a court-ordered cleanup where the court has not found such action necessary to prevent harm to the public or the environment.").

the environment *endangers* the environment would be to render the word ‘substantial’ superfluous, as practically *any* addition of a pollutant into the environment would give rise to liability.”); *Tilot Oil, LLC v. BP Prods. N. Am., Inc.*, 907 F. Supp. 2d 955, 967–68 (E.D. Wis. 2012).

To adopt a broader rule would contradict with the text and structure of the statute. As already discussed, relief on an endangerment claim in a citizen suit is authorized only as necessary to prevent harm from an imminent and substantial endangerment. 42 U.S.C. § 6972(a)(1)(B); *LAJIM*, 917 F.3d at 949. The Act gives broader authority to the agencies, though. Whenever “there is or has been a release of hazardous waste into the environment,” an agency “may issue an order requiring corrective action or such other response measure as [it] deems necessary to protect human health or the environment.” 42 U.S.C. § 6928(h); *see also* Ind. Code § 13-22-13-1, -2 (likewise for the state agency). That provision does not include the “imminent and substantial endangerment” qualification like the citizen-suit provision. In implementing that action, an agency could decide to authorize a site’s closure even with waste remaining in place permanently, so long as measures are taken to prevent harm to health or the environment. [*See* Tr. 543–44; Jx. 3 p 2 (noting that IDEM may authorize closure with contamination in place with appropriate institutional controls)]. Accepting the Plaintiffs’ argument that the existence of contamination in the ground or groundwater itself constitutes an endangerment to the environment and mandates injunctive relief would read the phrase “imminent and substantial endangerment” out of the statute and would transform an endangerment claim to a clean-up statute, which the Seventh Circuit has held it is not. *LAJIM*, 917 F.3d at 949; *see also Tri-Realty*, 124 F. Supp. 3d at 456.

The inquiry is thus not whether contamination exists somewhere in the environment, but whether that contamination may present a risk of harm to some aspect of the environment. *See Metacon*, 575 F.3d at 211–15 (affirming summary judgment against an endangerment claim even though some soil samples exceeded the agency screening level); *Avondale*, 170 F.3d at 695 (affirming summary judgment against an endangerment claim despite the presence of contaminants in the ground that could pose a danger if a route of exposure ever materialized); *Mallinckrodt*, 471 F.3d at 282 (noting with approval the district court’s recognition that “the mere presence of mercury contaminated sediments is alone not enough to constitute an imminent and substantial endangerment”); *Tri-Realty*, 124 F. Supp. 3d at 456 (“[A]n imminent and substantial endangerment to the environment in and of itself may exist if contamination threatens the ability of a non-living element of the environment to serve some potential function in the local ecosystem.”).

The contamination here does not pose such an endangerment. Again, the Plaintiffs do not claim that the contamination may present a risk to any plants or wildlife or any other living things. Nor does the evidence suggest that the contamination threatens to impair any potential function of the local ecosystem. As discussed above, the contamination is not at risk of reaching the wellfield, either. While there is still contamination in the soil and groundwater, the scope of contamination is generally stable or improving. Though there is a degree of variability over time, and some wells have reflected increases in TCE, the levels of contamination are generally decreasing. [Jx. 66 p. 8–10]. In addition, the Enhanced Reductive Dechlorination treatment walls further decrease the risk of an endangerment through worsening or migration of the plume. Those treatment walls break down the TCE as it travels across the site or reaches its border, which mitigates the possibility that contamination at the site could lead to worsening of the

contamination downgradient or to further migration. [Jx. 66¹³]. To the extent those effects may nonetheless occur in some amount, they are too minor to characterize as a “substantial endangerment” to the environment.

For the same reason, the Court cannot find that any leaching of TCE from the on-site soils into the groundwater may present an imminent and substantial endangerment to the environment. Any TCE that leaches into the groundwater is unlikely to travel any farther than the border of the property where the treatment wall has been installed—TCE is being reduced by more than 99 percent within the area of the western treatment wall. [Jx. 2, p. 12, fig. 5]. The TCE’s travel over that short distance does not threaten any serious harms to the environment and is not itself significant enough to constitute a substantial endangerment to the environment. *See Tilot Oil*, 907 F. Supp. 2d at 968 (holding that the lack of serious and ongoing threat, plus the remediation activities already undertaken, meant that the contamination did not present an imminent and substantial endangerment to the environment).

The Plaintiffs rely on *PMC, Inc. v. Sherwin-Williams Co.*, 151 F.3d 610, 618 (7th Cir. 1998), for the proposition that leaching to the groundwater constitutes an endangerment. But there the court affirmed an endangerment finding based on a “danger to the groundwater” because a cleanup was “necessary in the interest of health[.]” *Id.* The Plaintiffs argue that the court really meant that there was an endangerment to the environment alone, as the district court had found that the groundwater did not flow into a source of drinking water (a finding that was never mentioned in the court of appeals’ decision, and that even the district court didn’t mention

¹³ Jx. 66 p. 3 (“Ongoing treatment of groundwater contamination at the Site is reducing the mass of chlorinated ethenes migrating from the Site. The rate of migration will continue to decrease as the biobarriers continue to develop. . . . I expect that a fully mature set of biobarriers at the Site will further reduce the migration of chlorinated ethenes from the Site and continue to support downgradient enhanced natural attenuation processes[.]”), p. 8, 10.

in connection with its endangerment finding). That's not what the Seventh Circuit said though—it affirmed based on a threat to “health,” *id.*, a threat that is not present here. In addition, as already explained, the Court does not find that any impacts from leaching or migration are occurring or threatened here to a significant enough extent to qualify as “imminent and substantial” endangerments anyway.

The Plaintiffs also lament the pace and extent of remediation that has occurred over the years and argue that an injunction is necessary to effect a conclusive and comprehensive remedy. That puts the cart before the horse, though; the Plaintiffs have to establish an endangerment before the Court can impose injunctive relief. Their desire to remove the contamination more quickly or thoroughly than is occurring does not mean that the contamination that remains in place may present an imminent and substantial endangerment. *Tilot Oil*, 907 F. Supp. 2d at 967 n.16 (“Ultimately, [the plaintiff’s] argument appears to be that [the defendant] is simply not doing enough regarding the speed of cleanup. However, RCRA is not intended to remedy such a situation so long as there is no potentially imminent and substantial endangerment.”). Accordingly, the Court does not find that the Plaintiffs have proven that the contamination may present an imminent and substantial endangerment to the environment.

B. Vapor Intrusion

Finally, the Plaintiffs argue that the threat of vapor intrusion in the homes and structures in their neighborhood may present an imminent and substantial endangerment to health. TCE from the site migrated to the shallow groundwater, creating a plume of contamination extending into the neighborhood. TCE in the groundwater can volatilize into vapors, which then rise through the soil above the groundwater (the vadose zone) to reach the surface. When the vapors encounter a structure, they can enter the structure through cracks or other openings and infiltrate the indoor air. If the vapors do so in sufficient amounts, they can pose health risks. The evidence

shows that TCE vapors in fact infiltrated the indoor air of a number of structures in the Plaintiffs' neighborhood. The Plaintiffs thus argue that there is an ongoing threat of vapor intrusion by contaminants that are seriously dangerous to their health.

This theory presents a closer call than the others, but the Court cannot find that the Plaintiffs have proven that the contamination may present an imminent and substantial endangerment in this respect either. In sum, after vapor intrusion was first discovered in the neighborhood, vapor mitigation systems were installed in every structure that has ever had an indoor air sample exceed IDEM's screening level. Since then, not a single indoor air sample in any structure has exceeded those screening levels. Those samples and other lines of evidence prove that the mitigation systems—which are commonly used for this purpose—are successfully preventing any serious health risk; to the extent an endangerment existed before, Johnson Controls has already taken the steps necessary to eliminate that risk. The evidence does not show a risk of vapor intrusion in harmful levels in unmitigated structures or through preferential pathways, either. In addition, the treatment wall that has already been installed at the site's border minimizes the risk that contamination may worsen and cause exposures greater than those currently observed. Finally, the Court finds that IDEM's screening levels represent levels at which no appreciable risk of harm is present, and that Dr. Orris' opinions and the other levels the Plaintiffs resort to do not support a contrary finding. That the tests consistently show any exposure to be below those screening levels thus demonstrates that any vapor intrusion does not pose a serious health risk. The testimony by Johnson Controls' toxicological and epidemiological experts, whom the Court found to be credible, further supports that finding.

The Court must begin with a word of explanation on the significance of agency screening levels, which factor heavily in the parties' arguments and thus the Court's discussion. As

relevant here, an endangerment claim requires the Plaintiffs to “show that contaminants on the property are seriously dangerous to human health (or will be, given prolonged exposure over time).” *Liebhart*, 917 F.3d at 959. There is no requirement, however, “for a plaintiff to make ‘a particular quantitative showing as a *sine qua non* for liability.’” *Id.* (quoting *Interfaith Cmty. Org. v. Honeywell Int’l, Inc.*, 399 F.3d 248, 260 (3d Cir. 2005)). Likewise, “RCRA does not require that plaintiffs demonstrate contamination above some agency-derived threshold level of concentration.” *Id.* Thus, “state environmental standards ‘do not define a party’s federal liability under RCRA.’” *Metacon*, 575 F.3d at 212 (quoting *Interfaith*, 399 F.3d at 261 n.6); *Tilot Oil*, 907 F. Supp. 2d at 965 (“RCRA does not incorporate or otherwise rely solely on reference to regulatory standards, let alone any specific standard.”).

Even though they are not determinative, agency screening levels still play a central role in the parties’ arguments. As this discussion shows, however, the reason for that is not that the levels create legal requirements. Instead, the reason is that the Plaintiffs have chosen to rely almost entirely on screening levels as their evidence that the levels of contamination here are seriously dangerous to human health. An endangerment claim requires more than the presence of a potentially harmful contaminant; “there must be accompanying evidence that establishes some connection between the existing contaminants and some imminent and substantial endangerment to health.” *Liebhart*, 917 F.3d at 960.

Agency screening levels are one source of evidence that can supply that link. *See Interfaith*, 399 F.3d at 261 n.6. (Expert testimony is another, and both parties offer that evidence as well, as discussed below.) The Plaintiffs rely on various screening levels to draw a bridge between the contamination here and an imminent and substantial endangerment to their health. Johnson Controls, in turn, relies on IDEM’s screening levels as indicative of levels at which no

risk exists. That requires the Court to evaluate the nature and significance of the screening levels and decide what weight to place on them—along with the testimony from the medical, toxicological, and epidemiological experts. In doing so, the Court is not treating those levels as legal requirements but is simply evaluating to what extent the comparison to those levels reflects that the exposures at issue here may present an endangerment to health. With that caveat, the Court proceeds to the substance of the parties' arguments.

1. Vapor Intrusion in Mitigated Homes

At the outset, the Court acknowledges that TCE has been detected in the indoor air of homes in the neighborhood at levels that far exceed IDEM's screening level, which is $2.1 \mu\text{g}/\text{m}^3$ (micrograms per cubic meter) for indoor air. In May 2011, TCE was detected in the Schmuckers' home at $100 \mu\text{g}/\text{m}^3$ in the basement and $21 \mu\text{g}/\text{m}^3$ on the first floor, in the VanDiepenbos' basement at about $18 \mu\text{g}/\text{m}^3$, and in Mr. Stewart's basement at $5.2 \mu\text{g}/\text{m}^3$. TCE was detected in other homes in amounts as high as $180 \mu\text{g}/\text{m}^3$, which substantially exceeds IDEM's screening level. [Jx. 2, table 9]. On their own, those samples would present cause for concern.

Since those samples were taken, though, every home in which an indoor air sample exceeded IDEM's screening level has had a vapor mitigation system installed. After 2011, multiple rounds of testing have been conducted, in both mitigated and unmitigated homes, and not a single test of indoor air has exceeded IDEM's screening level. The VanDiepenbos and Stewart homes, along with several others, have not had any TCE detected in any sample since the mitigation systems were installed. Other homes, including the Schmuckers', have had some TCE detected, but in much smaller amounts. Even in those homes, most of the tests have been

non-detect for TCE, and many of the detections were in the range of an order of magnitude below the screening level.¹⁴ After 2011, only two tests have even exceeded $1.0 \mu\text{g}/\text{m}^3$.

As discussed in greater depth below, IDEM's screening level is a health-protective level at which no adverse health effects are expected, even if the most sensitive populations are continuously exposed to the substance in that amount for 30-years. [See Jx. 9 p. 15; Jx. 62 p. 5; Dx. O-1 p. 4; Tr. 1110–11]. The fact that sampling has not detected a single concentration of TCE in that amount since 2011 (much less continuously so) is strong evidence that exposures at levels capable of causing adverse health effects are not occurring in the area.¹⁵ [See Jx. 3 p. 3 (“In summary, the 2018 sampling results again confirmed the systems are effectively eliminating VI [vapor intrusion] risk because TCE was not detected in indoor air except for in two homes, and those two showed TCE concentrations well below the IDEM screening level.”)].

The Plaintiffs attempt to downplay the significance of these tests, but the Court is unpersuaded by those arguments. First, as the Plaintiffs note, the homes have not been subject to continuous testing. Most of the mitigated homes have had three rounds of testing since the mitigation systems were installed—in 2011, 2018, and 2019. More frequent testing would have provided stronger evidence, and the Court acknowledges that these tests themselves are not

¹⁴ Two homes had tests over the screening level in October 2011, after the mitigation systems were first installed, but in the crawlspace, not in indoor air, and no test after 2011 has exceeded the screening level in any area. In one of those homes, the mitigation system was modified after the October 2011 testing. [Jx. 25 p. 14]. No TCE was detected in the next two sampling rounds in that home, and only $0.12 \mu\text{g}/\text{m}^3$ was detected in the most recent round.

¹⁵ The highest detection has been $1.9 \mu\text{g}/\text{m}^3$, which is still below the $2.1 \mu\text{g}/\text{m}^3$ screening level. Dr. Keramida suggests that the vapors may have actually been above that level because laboratory results often have a margin of error of 10 to 20 percent. [Jx. 53 p. 9]. She does not cite a source for that margin, though, nor does she identify the margin for this particular test. Regardless, as discussed elsewhere, screening levels are not thresholds at which a risk of adverse health effects begins, and they already have margins of safety built in; even if the actual concentration was higher by 20 percent, there would still be no appreciable risk of a health effect. This test below the screening level thus fails to show that a health risk may be present.

dispositive. But still, scores of tests have been conducted in these homes over multiple rounds of testing, and they have uniformly shown that vapors are not present in indoor air above the screening levels, which the Court views as a strong line of evidence.¹⁶ [See Tr. 420 (“When you look at state guidance and how you assess the effectiveness of a mitigation system, the first line of evidence is the indoor air.”)]. In addition, the Plaintiffs (who have the burden of proof) could have conducted further testing if they did not believe that the tests conducted by Johnson Controls were representative of the actual indoor air exposures that are occurring. Yet they have not done so. In fact, they have not conducted a single sample of indoor air, which undercuts their argument that the number of tests has been deficient.

Dr. Keramida also relies on a study to argue that the concentrations being captured by the tests are likely not representative of the actual conditions over time.¹⁷ Again, the Court is unpersuaded. Dr. Keramida cites an EPA Errata document that notes that “a single, randomly drawn, one-day sample had an approximately eighty percent chance of being less than the true

¹⁶ In response to the Plaintiffs’ post-trial submission of an exhibit not offered at trial, Johnson Controls submitted the results from the most recent round of testing in early 2020. [DE 462-1]. The Plaintiffs did not respond or object to the consideration of that data. Those results reinforce these findings. Of the 17 homes that had their indoor air tested, 15 had no TCE detected at all; one detected about 0.65 $\mu\text{g}/\text{m}^3$ in the basement but none in the first floor; and another detected 0.34 $\mu\text{g}/\text{m}^3$ in the basement and 1.1 $\mu\text{g}/\text{m}^3$ in the first floor—all well below the screening level. A number of homes had their subslab vapors tested too. None of those tests exceeded or even approached the subslab screening level, and 10 of them did not detect any TCE at all. The Interra Credit Union also had detections of only 1.1 $\mu\text{g}/\text{m}^3$ and 0.92 $\mu\text{g}/\text{m}^3$ of TCE in indoor air, well below the screening level for commercial structures of 8.8 $\mu\text{g}/\text{m}^3$. (The Court has considered the Plaintiffs’ post-trial submission as well, though there is no apparent reason for its late submission, but to be clear, the Court’s conclusion does not turn on whether the Interra Credit Union is currently occupied.)

¹⁷ In a supplemental report, Dr. Keramida opined that the presence of PCE in indoor air demonstrated that vapor intrusion was occurring, even if TCE was not detected at the time of the test, because PCE has a longer atmospheric lifetime. [Jx. 51 p. 14–15]. The Court cannot find that opinion to be sound, though, for substantially the same reasons noted by Dr. Dawson in response. [Tr. 606–07].

mean” of the level of vapor intrusion that was actually occurring, given the spatial and temporal variability of vapor intrusion.¹⁸ [Jx. 51 p. 15–16, ex. 12; DE 425-1 ¶ 46]. The parties dispute whether this was meant to reflect only the observations at a single site or was representative of vapor intrusion sites in general.¹⁹ Even accepting this statement on Dr. Keramida’s terms, however, offers little support for the Plaintiffs’ position.

First, the tests here were neither “single” nor “randomly drawn.” As already noted, scores of tests have been conducted in the neighborhood, and multiple rounds of tests have been conducted in every home, not just one. The tests were not random, either, but were taken at times most likely to reflect the worst-case conditions. [See Jx. 2 p. 7 (noting that sampling was conducted “during the heating season in the early spring of 2019”); Jx. 10 p. 22 (recommending that samples be taken “during the late winter or early spring” and while a heating system is operating, to capture “worst case conditions”); Tr. 479 (noting that sampling was conducted during the “worst-case season”); Tr. 719]. In addition, *one hundred percent* of the tests of indoor air have been below the screening level. [Jx. 3 p. 5 (“All detections of cVOCs in indoor air of homes with mitigation systems have been below IDEM screening levels. This indicates to IDEM that the mitigation systems are adequately addressing the vapors in indoor air.”)]. Moreover, as Dr. Dawson testified, homes with mitigation systems are less subject to variability, which further reduces any concern that the tests are not reflective of the true conditions. [Tr. 625].

¹⁸ There is no dispute, however, that the tests accurately reflect the conditions during the 24-hour period each test was conducted.

¹⁹ The study on which this statement was based offers its own disclaimer in that regard: “[I]t is unknown whether or not the data from this study site are representative of other VI-sites, so caution should be exercised in extending lessons-learned at this site to other VI sites.” [Jx. 51, ex. 11 p. 200].

The Plaintiffs also argue that the vapor mitigation systems are not sufficiently effective or reliable to prevent harmful vapor intrusion, such that an endangerment is at least threatened or potential, even if it has not been occurring. First, though, the testing data shows that the systems function quite effectively. Confirmatory sampling is the first line of evidence for determining whether a mitigation system is functioning properly. [Tr. 420; Tr. 487–88; Jx. 12 p. 1 (“In Indiana, confirmatory sampling is the primary method for assessing a mitigation system’s effectiveness[.]”).]. As already discussed, concentrations have dropped dramatically since the systems were installed, with no screening level exceedances after 2011. [Jx. 2, table 9; Jx. 3 p. 3, 5].

In addition, vapor mitigation systems are commonplace and are commonly relied on by regulators in these circumstances to prevent a health risk from vapor intrusion. As Dr. Dawson testified, these types of systems, which are the same ones used for radon, are “the most common and successfully employed approach to structure mitigation for VOC vapor intrusion.” [Jx. 73 p. 14; DE 424-1 ¶ 12 (“The use of sub-slab depressurization systems, which inhibit vapors from migrating through a building’s foundation into indoor spaces, is a common approach to vapor mitigation, approved by EPA and IDEM. Sub-slab depressurization systems have been installed on a permanent basis and operate in many thousands, if not millions, of homes around the country and have been shown to effectively mitigate radon intrusion. More recently, these systems have been successfully employed to mitigate vapor intrusion by volatile organic compounds, having been approved by EPA and IDEM for that purpose.”); Tr. 620 (noting that subslab depressurization systems are “what EPA considers a presumptive remedy, one that has been shown and demonstrated in the past and in many areas to be effective and appropriate”); Tr. 530 (noting that mitigation systems are in place in at least half of the sites being handled by

IDEM's project manager)). IDEM shares that view, characterizing depressurization systems as "the only proven long term mitigation system for sub-surface vapor intrusion." [Jx. 12 p. 7]. It further notes that "[d]epressurization systems are the most common vapor mitigation technique and are successfully employed at myriad sites in Indiana." *Id.* p. 2.

Pressure differential testing further confirms that the systems are succeeding in creating a vacuum in the subsurface, which inhibits vapors from entering indoor air. Pressure differential testing is typically the second line of evidence for confirming the effectiveness of mitigation systems, after indoor air tests. [Tr. 420]. Here, the pressure differential data, which were collected from 13 of the 15 mitigated homes, reflected positive pressure in the homes relative to the subslab area, confirming that the systems were working as intended. [Jx. 76 p. 6–7; DE 424-1 ¶ 13; Tr. 632 ("[E]very mitigated building on this page shows a . . . positive pressure differential, which means vapor intrusion was inhibited.")). Differential pressure testing in some adjacent, unmitigated homes also reflected slightly pressurized conditions, indicating that the vapor mitigation systems' impact may extend somewhat beyond the footprint of the mitigated homes. [Jx. 76 p. 7; *see* Jx. 75 p. 3].

Other measures further confirm that the systems will continue to provide adequate protection against a risk of harmful vapor intrusion. When the vapor mitigation systems were installed, other protective measures were also implemented. Concrete was placed over bare areas of some of the floors, and cracks and openings were sealed with caulk or other materials, in order to limit the flow of vapors into the structures. [Jx. 25 p. 12; Tr. 518]. The systems have also been inspected twice a year, and maintenance has been conducted when appropriate, and those inspections are planned to continue for as long as the systems are still in use. [Jx. 1 p. 35]. During those inspections, Johnson Controls' contractor verifies that the systems are functioning

properly and are drawing a vacuum, and inspects the areas for any new cracks that may need to be sealed. [Tr. 518]. The occupants of the buildings are also educated on the systems' functioning. [Jx. 1 p. 35; Tr. 518]. The systems' fans produce an audible noise, so if a fan was to stop running it could be noticed by the occupant, and the systems have manometers that provide a visual indication that the system is producing a vacuum.²⁰ [Tr. 518, 731–32].

As the Plaintiffs note, there is no binding order from a court or agency that compels Johnson Controls to continue its inspections and maintenance. The Court has no reason to believe that Johnson Controls will stop doing so, though. Johnson Controls has been consistently and actively monitoring the contamination in general, and the mitigation systems in particular, under IDEM's oversight as part of IDEM's Voluntary Remediation Program. That program is, as its name suggests, voluntary, but there is no indication that Johnson Controls may withdraw from that program or fail to fulfill its commitments. Participating in the Voluntary Remediation Program is a condition of Johnson Controls' approved closure plan to terminate its status as a treatment, storage, or disposal facility. [DE 351 p. 33, 37]. Withdrawing from that program could subject it to an enforcement action, whereas completing that program would result in a covenant not to sue. [*Id.*; Tr. 537, 555]. IDEM is engaged on this issue, too. In response to Plaintiffs' counsel's comments to the initial work plan, IDEM directed Johnson Controls to “[d]evelop an O&M plan to address continued long-term operation and maintenance (O&M) of the residential vapor mitigation systems,” [Jx. 4], and Johnson Controls updated its plan accordingly.²¹ [Jx. 1 p. 35].

²⁰ One home has an audible alarm installed for its crawlspace system, as the manometer would not have been accessible to view.

²¹ IDEM has not yet granted approval for the plan, nor would its approval prevent an injunction if an endangerment existed and the plan was insufficient to remedy it, *Liebhart*, 917 F.3d at 963,

As the Plaintiffs also note, some of the systems have experienced interruptions of some sort over the years. [Jx. 43]. Those interruptions have not been frequent, though. Most of the systems have never had any problem, and the few systems that have had issues do not demonstrate that the systems are inadequate or unreliable. In one home, one of the two fans was erroneously wired into the wrong side of a light switch that was turned off. The wiring has since been fixed, though, and even when it was wired improperly the home still did not have any detections of TCE. [Tr. 414]. Other interruptions occurred only because a home was vacant and the electricity was turned off. On other occasions, issues were discovered during routine inspections and were promptly corrected. There is no evidence that any of these interruptions led to elevated levels of TCE in indoor air; again, not a single indoor air sample since the systems were installed has exceeded IDEM's screening level. [Tr. 424].

In addition, the Plaintiffs have not shown that vapors may enter in harmful amounts if any of the systems malfunctioned. Given the ongoing inspections, a system could be out of order for up to six months at the longest. The Plaintiffs have not addressed how quickly the vapors may begin entering a home if a system stopped, though, and have not offered any basis to find that harmful levels of vapors could result in that time. In addition, sub-slab vapor levels at unmitigated homes in the neighborhood have reduced dramatically since the mitigation systems were first installed in 2011.²² [See Jx. 2 table 12; Jx. 75 p. 3; Jx. 76 p. 5, fig. 3S.2-4; Tr. 491–92].

but IDEM's action in this respect helps support the conclusion that the systems will continue to be adequately monitored and maintained.

²² The sub-slab vapor levels below the Interra Credit Union have reduced dramatically, too, though some of them remain above the screening level. [Jx. 2, table 14]. The Plaintiffs also cite the elevated soil gas levels on the Weiland property. *Id.* However, the soil gas testing done in the neighborhood shows that the elevated levels at the Weiland property (which is side-gradient, not upgradient, from the neighborhood) do not translate to elevated levels in the neighborhood, and lateral diffusion through the soil is not a threat at that distance. [Tr. 591].

In fact, all of those sub-slab tests are now below the soil gas screening levels.²³ [Jx. 76 p. 6, fig. 3S.2-4]. The mitigation systems are not the only precaution, either; contractors also sealed cracks and installed other barriers to impede vapors' ability to enter the structures.²⁴ Given all those factors, the possibility that a system would malfunction, and would then remain off for long enough for harmful levels of vapors to enter, is simply too remote and speculative to qualify as an imminent and substantial endangerment.

The Plaintiffs also argue that mitigation systems are interim measures that do not remediate the underlying contamination. The role of an endangerment claim, though, is to prevent any endangerment to health. Vapor mitigation systems are commonly used for that very purpose and are successfully doing so here. The contamination is still being remediated under IDEM's oversight, but because the vapor mitigation systems and all of evidence just discussed demonstrate that no serious health risk exists or is threatened, that underlying contamination does not give rise to an imminent and substantial endangerment.

2. Vapor Intrusion in Unmitigated Structures and through Preferential Pathways

The Court likewise does not find that the contamination may present an endangerment in unmitigated residential or commercial structures or through preferential pathways, either. First, no unmitigated structures have *ever* had an indoor air test exceed IDEM's applicable screening level. TCE has rarely been detected in any unmitigated residential homes. [Jx. 2 table 9]. The few detections have mostly been around an order of magnitude below IDEM's screening level, and not a single indoor air test has exceeded that level. *Id.* As just noted, the subslab vapor tests

²³ The test results submitted post-trial are consistent with that finding, as the sub-slab screening levels were not exceeded in any mitigated or unmitigated homes.

²⁴ To be sure, these measures do not mean that the basements are hermetically sealed from the subslabs or that no gaps exist, but they still offer a measure of protection.

further support a conclusion that those homes are not at risk from elevated levels of vapors.

Many of the unmitigated homes in the area have never had TCE detected even in the subslab soil gas, and no TCE has been detected at a residence above IDEM's subslab screening level since 2011. [Jx. 2 table 12]. The evidence thus does not reflect that these homes are at any risk of harm from TCE vapor intrusion.

The same goes for other, non-residential structures in the area. Goshen High School, which is at the far end of the plume of contamination, has never had any TCE detected in its indoor air. [Jx. 2, table 10]. Subslab vapor testing at the high school in 2019 only detected TCE in one of the eight locations tested, and in an amount about half of the screening level. [Jx. 2, table 13]. Other commercial structures have likewise never had an indoor air test exceed IDEM's screening level for commercial properties, which is $8.8 \mu\text{g}/\text{m}^3$. [Jx. 2, table 11]. Even though the subslab vapors are elevated below the Weiland property (which is northwest of the site), the indoor air tests have never come within half of the screening level. [Jx. 2, tables 11, 14]. The closest case is the Interra Credit Union property, which has had indoor air detections of TCE between 1.8 and $8.4 \mu\text{g}/\text{m}^3$. Even then, every single one of those tests has been below IDEM's screening level, which is a health-protective level that already builds in margins of safety. Again, if the Plaintiffs did not believe the tests that have been conducted accurately reflected the true conditions, they could have sought to conduct additional tests, but they never did. Thus, for similar reasons as discussed above, the Court cannot find that the vapors may present an imminent and substantial endangerment to health in that structure, either.²⁵

²⁵ Moreover, even if the Court found that the vapors may present an imminent and substantial endangerment in this structure, that would not justify the far-reaching injunctive relief and comprehensive remediation the Plaintiffs seek. Instead, the relief would simply be to require Johnson Controls to offer to install a vapor mitigation system in that building. That would be sufficient to eliminate any health risk from vapor exposures in that building.

The Court likewise does not find that the possibility of vapor intrusion through preferential pathways may present an imminent and substantial endangerment. Preferential pathways are conduits such as sewer lines that can become infiltrated by vapors and, conditions permitting, can transport those vapors into structures. The biggest issue posed by preferential pathways is that they cannot be redressed by vapor mitigation systems. The mitigation systems pull vapors from the soil below a structure, but preferential pathways can allow vapors to enter through utility connections instead of rising into a structure from the soil. Thus, if vapor intrusion from preferential pathways was occurring, some measure other than mitigation systems would be required.

The Plaintiffs have not shown that preferential pathways may present an endangerment here, though. For obvious reasons, homes are designed to prevent gases in the sewer lines from entering indoor air. The presence of vapors in the sewers thus does not mean that a home is at risk of vapor intrusion. [Jx. 73 p. 12 (“[V]apor intrusion impacts from utility conduits require either improperly sealed utility connections to structures or leakage from cracked conduits to the soil.”)]. Here, most of the sewers that have been tested have not detected TCE. [Jx. 76 p. 8, table 3S.4-1]. Vapors consistent with the site’s signature (meaning a similar ratio of contaminants as at the site) have been detected in two sewer lines, but the evidence does not suggest that harmful vapor intrusion is occurring or at risk from either of those lines.

TCE has been detected in the line by 16th and Egbert, at the southwest corner of the site, and in the line along Monroe, which runs to the west of the site. [*Id.*; Jx. 51, ex. 8 fig. 5]. After TCE was detected in the sewer line at 16th and Egbert, paired samples were taken at the same time in the sewer and in the indoor air of adjacent homes. [TR. 444]. While TCE was again detected in the sewer, though in smaller amounts, no TCE was detected at all in the homes

connected to that line, indicating that a completed pathway was not present between the sewer line and the indoor air. [Jx. 2, table 9 p. 8–9; Jx. 73 p. 12]. Other rounds of sampling in that area have been almost entirely non-detect for TCE, with the sole exception being one detection that was below the screening level by over an order of magnitude. [Jx. 2, table 9]. The homes along Monroe have had multiple rounds of testing too, as they sit above the plume and have mitigation systems. As already discussed, none of those homes have had TCE detected above IDEM's screening level since the vapor mitigation systems were installed. The evidence thus fails to show that homes in the neighborhood are subject to vapor intrusion from the sewer lines. [Tr. 599–600].

Dr. Keramida's opinions to the contrary rely on speculation and unexamined assumptions. For example, Dr. Keramida noted in her initial report that "contaminated gases from within a sanitary sewer can enter a building directly at any given time, through its sewer connection, *if* the building's plumbing is not designed, constructed or maintained properly." [Jx. 49 p. 20 (emphasis added)]. She did not proceed to analyze, though, whether that "if" is present here. [See Tr. 144–45]. Instead, she offered a bare assertion that TCE vapors would have been found in the indoor air of the homes near 16th and Egbert had they been sampled when that line was first sampled. [Jx. 49 p. 21]. Nothing in the report connects the dots from that premise to that conclusion, and the testing data does not show that those conditions are present. Nor did Dr. Keramida address even at a general level how common the sorts of defects are that might allow vapor intrusion from the sewers. Her testimony on redirect at trial offered some examples of problems that may allow vapors to enter, such as if a drain trap dries out. [Tr. 238]. Even then, her testimony at a high level of generality offers little basis to evaluate the likelihood that such a defect may occur in the homes at issue here such that they may become subject to vapor

intrusion. An endangerment claim does not require that harmful exposures are already occurring, but it requires more than just a hypothetical, speculative possibility that such an exposure could occur under some conceivable circumstance. *Liebhart*, 917 F.3d at 960. The Plaintiffs have not shown more than a speculative risk that any harmful exposure may occur through the sewer lines, so the Court cannot find that the contamination may present an imminent and substantial endangerment in that respect, either.

3. Enhanced Reductive Dechlorination Treatment Walls

Not only does the evidence show that the contamination currently in the neighborhood does not pose a risk of harmful vapor intrusion, the remedial activities Johnson Controls has taken at the site ensure that the vapors will not increase and pose a risk in the future. In particular, Johnson Controls injected Enhanced Reductive Dechlorination treatment walls at the site. Those treatment walls will prevent the elevated levels of TCE that remain at the site from migrating into the neighborhood. The on-site contamination thus does not create a risk of harmful vapor intrusion in the neighborhood.

First, the Court does not find that the neighborhood is at risk from lateral diffusion of vapors (meaning lateral migration of vapors through the soil). Though Dr. Keramida opined that such a risk is present, the Court is persuaded by Dr. Dawson's opinion to the contrary. [Tr. 591]. As Dr. Dawson explained, elevated concentrations of TCE in the soil vapors correspond very strongly to the elevated concentrations of TCE in the shallow groundwater. [Tr. 570 (noting that while vapors diffuse laterally for a short distance, "the highest concentration gradient is between the source and the ground surface, and that's the direction that vapors ultimately travel."), 583–84 ("That is a classic vapor intrusion pathway evaluation that indicates the groundwater plume is responsible for -- or was responsible for the exceedances in the slab, which in turn are where we saw exceedances in indoor air."); Tr. 589–91]. That demonstrates that the contaminated

groundwater, not lateral diffusion through the soil, is responsible for producing the vapors in the neighborhood.

To the extent contamination at the site presents a risk to the neighborhood, then, it would be through TCE leaching from the soil to the shallow groundwater, which then flows under the neighborhood, where it could create vapors. [Tr. 591 (“So the soil source zones are contributing to the groundwater contamination. It’s the groundwater that is flowing laterally. And as it flows, it off-gases, and we see concentrations in the soil. Where the groundwater isn’t, we see very low to non-detect soil concentration.”)]. The treatment walls interrupt that process, though, by removing TCE from the shallow groundwater before it exits the site. [Tr. 1069]. Most notably, a treatment wall was injected at the western boundary of the site. That treatment wall is mature and is removing in excess of 99 percent of the TCE from the groundwater in the treatment zone.²⁶

It is still an open question how far downgradient that treatment zone will extend and whether it will remediate the plume of shallow groundwater contamination throughout the neighborhood. At the very least, however, that treatment wall minimizes the risk of any further contaminant loading from the site. Even if TCE leaches into the soil at the site, the groundwater will pass through the treatment wall before entering the neighborhood, so the groundwater that enters the neighborhood will be clean (or nearly so). [Jx. 66 p. 3 (“Ongoing treatment of groundwater contamination at the Site is reducing the mass of chlorinated ethenes migrating from the Site. The rate of migration will continue to decrease as the biobarriers continue to develop[.]”); Tr. 463 (noting that the treatment wall was installed to prevent any further TCE loading)]. That process can also be expected to further reduce the vapor levels in the

²⁶ The treatment wall requires monitoring and may require maintenance over time, but for reasons already discussed, the Court cannot find a reasonable probability that Johnson Controls will cease doing so.

neighborhood through the process of attenuation. [Jx. 66 p. 8 (“[A]ttenuation of the remaining source and plume core will result in improvements in water quality downgradient at MW-36WT as groundwater continues to migrate beneath the neighborhood.”), p. 10 (“[A] bio-barrier is capable of effecting groundwater remediation throughout a downgradient plume simply by intersecting and treating the source of the plume.”); DE 424-1 ¶ 7 (“As TCE in groundwater is reduced through the expansion of the ERD remedy, vapors associated with TCE in groundwater also will continue to be reduced.”)]. Thus, not only is there no reason to believe that vapor levels will worsen as compared to the levels that have been observed over the last eight years, those conditions are likely to continue to improve. And because the evidence already discussed does not show that the vapors may present an endangerment to the neighborhood under current conditions, there is no imminent risk that they may do so in the future, either.

4. Health Effects and Screening Levels

Thus far the Court has referred to IDEM’s screening levels. As already discussed, the reason for that is not that they set legal requirements or that the standards in a given state govern an endangerment claim in that state. *Liebhart*, 917 F.3d at 959; *Interfaith*, 399 F.3d at 260; *Metacon*, 575 F.3d at 212. Instead, the Court finds that they are health-protective levels at which no adverse health effects are expected, and thus reflect the absence of a serious health risk. [*See, e.g.*, Tr. 788–89 (Dr. Fedoruk)]. The Plaintiffs invoke a variety of other levels and argue that exceedances of those levels may present an endangerment, but the Court disagrees.

To begin with, screening levels do not reflect levels above which serious health effects may occur. Instead, they represent levels at which no effects are expected. [*See* Jx. 63 p. 20 (noting that a Reference Concentration is defined as an “estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious

effects during a lifetime”)]. They do not represent thresholds for adverse effects, either, as they have multiple conservatisms built in. [Jx. 63 p. 20 (Dr. Fedoruk); Jx. 9 p. 15 (“In practice, the protective assumptions built into the screening levels make the probable additional carcinogenic risk of using those levels under appropriate land use scenarios substantially lower than 10^{-5} . Non-carcinogenic effects at screening levels are also unlikely, for the same reason.”)]. Exceeding a regulatory screening level thus does not indicate a risk of an adverse health effect. [Dr. Chang: Jx. 61 p. 16, 23; Tr. 1110–11 (“[Reference concentrations are] specifically defined as regulatory values that are meant to be protective and below which we don’t expect to see adverse health effects. But they’re not a demarcation of some sort of threshold for health problems.”)]. Exceeding a screening level does not even necessarily prompt any action or cleanup; further monitoring or assessment will sometimes be the only response. [Dx. G-11 (“[Screening levels] are chemical-specific concentrations for individual contaminants in air, drinking water and soil that may warrant further investigation or site cleanup. . . . It should be emphasized the [screening levels] are not cleanup standards.”); Jx. 9 p. 15 (“Screening levels are like ‘first cut’ values—if chemical concentrations at a site do not exceed screening levels, the site is generally eligible for closure, though conditions may apply. An exceedance of screening levels indicates the need for additional evaluation.”); Jx. 61 p. 16 (Dr. Chang)]. *See also Metacon*, 575 F.3d at 212–13; *Tilot Oil*, 907 F. Supp. 2d at 965.

Because screening levels represent the lack of a risk, not the threshold for where a risk may occur, it is inappropriate to cherry-pick the most stringent levels and to suggest that they reflect the level at which an endangerment may occur. If screening levels are what they claim to be, then it should be appropriate to use the *highest* level, not the lowest. If no risk is present at the highest level, then no risk would be present at the lowest, either, but the lack of risk at the

lowest level does not imply the existence of risk at the higher. [Jx. 62 p. 5 (Dr. Chang)]. IDEM's screening level is not an outlier, either, as might suggest that it is unworthy of credence; at least a dozen other states use similar or higher screening levels. [Jx. 73 p. 7; Tr. 1265]. Dr. Keramida's practice in her own projects of allowing her clients to pick which screening levels to use further undermines her effort in this case to apply the most stringent level she can find and to suggest it represents a level above which a risk to health may exist. [See Tr. 165, 173–74].

With that understanding, the Court addresses the various other levels the Plaintiffs raise, beginning with the cancer screening level. For cancer effects, screening levels are based on the number of additional cancers expected in the background rate in a population, assuming the population is continuously exposed to the substance for a lifetime. Agencies generally view the acceptable range of risk to be between one additional cancer in a population of one million people (10^{-6}) to one in ten thousand (10^{-4}). [Dr. Dawson: Tr. 575–76, 650; Jx. 73 p. 5]. IDEM uses a cancer screening level based on a risk of one in one hundred thousand (10^{-5}), which is the traditional risk level used by the RCRA program. [Dr. Dawson: Jx. 73 p. 5; Tr. 684]. The 10^{-5} cancer risk corresponds to a screening level for TCE of $4.8 \mu\text{g}/\text{m}^3$.

The EPA, however, uses the 10^{-6} cancer risk in screening for TCE, which corresponds to a screening level of $0.48 \mu\text{g}/\text{m}^3$. The Plaintiffs argue that because some tests have detected TCE above that amount, TCE may present an imminent and substantial endangerment to health. The Court disagrees. Again, the 10^{-6} cancer risk equates to an additional one-in-a-million chance of cancer, assuming a person is continuously exposed to vapors in that amount for their lifetime—24-hours a day, 365 days a year, for 70 years. Only 16 homes in the neighborhood have ever had TCE detected above $0.48 \mu\text{g}/\text{m}^3$. Even if multiple people spent their entire lives inside each of those homes, being constantly exposed to that amount of TCE, giving rise to a one-in-a-million

risk, there is still a vanishingly small chance that even a single excess cancer would occur.²⁷ [See Tr. 758 (Dr. Fedoruk explaining that if the entire City of Goshen was exposed to a cancer risk of 10^{-5} for their entire lifetimes, not even a single excess cancer would be expected)]. Not only is that risk far too remote to be considered an imminent and substantial endangerment, but the conservatisms built into both the screening level²⁸ and the exposure assumptions ensure that the actual risk is much, much lower. [See Jx. 9 p. 15; Tr. 1128, 1132–33 (Dr. Chang)]. In addition, after 2011, only four homes have had TCE detected in that amount, and no home has had more than one such detection. That shows that no long-term exposure to this level is occurring, even if a lifetime of exposure to this level would represent an endangerment. This same analysis would apply to Dr. Orris’ opinion that an endangerment exists based on the “Inhalation Unit Risk” of a four-in-a-million chance of cancer at a lifetime of exposure to $1 \mu\text{g}/\text{m}^3$ of TCE. [Jx. 59 p. 11; Tr. 320–21; *see also* Tr. 1131–32 (Dr. Chang testifying that at an exposure of $1 \mu\text{g}/\text{m}^3$, it would take one million years of exposure to produce the cumulative amount of exposure at which an increased risk of cancer in humans has been observed)].

Testimony by Johnson Controls’ experts further supports that conclusion. As Dr. Fedoruk testified, even ordinary experiences like taking a cross-country flight or eating peanut butter can carry a 10^{-6} cancer risk. [Tr. 756–57]. Dr. Chang likewise testified that toxins in the ambient air often exceed a cancer risk of 10^{-5} , and that epidemiological studies show that the concentrations at which an increased risk of cancer has been observed in humans from exposures to TCE were orders of magnitude higher than the concentrations at issue here. [Tr. 1129–32; Jx. 61 p. 8–9,

²⁷ Assuming 10 people spent their entire lives inside those homes, such that 160 people were exposed to a one-in-a-million risk, there is still a greater than 99.98 percent chance that the risk would not materialize.

²⁸ Such as the assumptions that the dose–response relation is linear and that no threshold exists for an increased risk, which are not based on observation. [Dr. Chang: Tr. 1128, 1132–33].

18–19]. Even Dr. Orris, the Plaintiffs’ health expert, acknowledged that the levels of exposure here are comparable to common background levels. [Tr. 335]. Moreover, as Dr. Dawson testified, even though the EPA uses the 10^{-6} screening level, it doesn’t necessarily take action when a test comes back at that level; its response is often just more monitoring. [Tr. 685, 689–90]. That demonstrates that, whatever value the 10^{-6} cancer risk level may have for regulatory screening purposes, it does not show that any exposures here may present an imminent and substantial endangerment to health. Of course, the Plaintiffs do not have to show that the contamination *will* cause adverse effects here; an increased risk can suffice, and the legal standard is meant to be protective. *See Liebhart*, 917 F.3d at 958–61. But the Plaintiffs have not shown more than a *de minimis* and speculative risk based on the low-level exposures that may occur here.

The alternative levels the Plaintiffs invoke for toxic (non-cancer) effects likewise fail to indicate that the levels of exposure at issue here may present an imminent and substantial endangerment to health. Screening levels for toxic effects are based on the EPA’s Reference Concentration, which is defined as “an estimate (with uncertainty spanning perhaps an order of magnitude),” of a continuous exposure “to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.” [Jx. 14 p. 1-1]. In other words, if the entire population was continuously exposed to a substance at that amount, no appreciable risk of health effects would be expected, even in the most at-risk populations. The Reference Concentration is then adjusted by exposure assumptions for different settings to produce screening levels for those settings. It can also be adjusted by a Hazard Quotient to account for different risk levels.

Agencies typically consider a Hazard Quotient of 1.0 to represent an acceptable risk level, and IDEM's residential screening level at a Hazard Quotient of 1.0 is $2.1 \mu\text{g}/\text{m}^3$. Dr. Keramida opines, however, that a Hazard Quotient of 0.1 should apply, producing a screening level of $0.21 \mu\text{g}/\text{m}^3$, due to the presence of multiple contaminants. [Jx. 49]. Dr. Keramida has not shown that using a Hazard Quotient of 0.1 instead of 1 is probative of whether an endangerment may exist here, though. A Hazard Quotient of 0.1 applies only where multiple contaminants are present that share the same toxic endpoint. [Dx. G-11 p. 18 ("Site-specific [screening levels] corresponding to an HQ of 0.1 may be appropriate for those sites where multiple chemicals are present that have [Reference Concentrations] based on the same toxic endpoint."); Dr. Dawson: Jx. 73 p. 6; DE 424-1 ¶ 9].

TCE does not have the same toxic endpoint as any of the other substances here, though. [Dr. Dawson: Jx. 74 p. 1; Tr. 581–82]. Though the EPA may recommend the use of a Hazard Quotient of 0.1 for preliminary screening purposes when multiple contaminants may be present, [Tr. 581–82, 711], the contaminants and their toxic endpoints are already known here. Thus, that precaution might be appropriate for regulatory or investigatory purposes, but it has no bearing on the effects associated with the contamination in question here. The screening levels based on a Hazard Quotient of 0.1 are therefore not useful in evaluating whether the contamination here may present an endangerment.

The Plaintiffs also rely on stricter screening levels adopted by EPA Regions 9 and 10. Those screening levels are also based on the EPA's Reference Concentration for TCE. However, because that Reference Concentration is based in part on the risk of fetal cardiac malformations (extrapolated from animal studies), which can develop during a three-week period during pregnancy, these regions set screening levels based on the assumption that a risk could occur

from a three-week exposure period instead of over a lifetime of exposure. The screening levels are thus slightly lower— $2.0 \mu\text{g}/\text{m}^3$ for residential exposures and 8.4 or $8.0 \mu\text{g}/\text{m}^3$ for commercial exposures—and the agencies seek to prevent even short-term exposures at those levels. [Px. 169 (“If such concentrations are exceeded, measures to expeditiously reduce exposure should be considered.”), 207].

The difference in the screening levels themselves is largely academic. Whether the residential screening level is 2.1 or $2.0 \mu\text{g}/\text{m}^3$, no indoor air test in any home has exceeded those levels since the mitigation systems were installed. [Jx. 2 table 9]. No test in any commercial structure has exceeded the Region 10 commercial screening level of $8.4 \mu\text{g}/\text{m}^3$, either. The highest detection was a single test in the Interra Credit Union of $8.4 \mu\text{g}/\text{m}^3$, which is at—not above—the screening level, and would not trigger action even under Region 10’s standards. [Px. 169]. Region 9’s commercial screening level is lower, at $8 \mu\text{g}/\text{m}^3$, but the difference is illusory. Region 9’s calculation produces the exact same level as Region 10, it just rounds it down to the nearest whole number.²⁹ [Px. 207 p. 3]. That sort of artificial adjustment may be perfectly appropriate for regulatory screening purposes, but it bears no connection to evaluating whether an imminent and substantial endangerment may be present. To the contrary, it is just a further illustration of how screening levels, with the conservatisms and margins built in by the agencies, reliably reflect the lack of a risk but not the level above which a risk may be present. [Dr. Chang: Jx. 61 p. 23; Jx. 62 p. 5]. Thus, again, it is a misuse of screening levels to pick the most stringent level and then suggest that any higher level of exposure creates a risk of adverse health effects.

²⁹ “Commercial/Industrial accelerated response action levels are calculated as a time-weighted average from the RfC, based on the length of a workday and rounding to one significant digit (e.g., for an 8-hour workday: Accelerated Response Action Level = (168 hours per week/40 hours per week) $\times 2 \mu\text{g}/\text{m}^3 = 8 \mu\text{g}/\text{m}^3$.” [Px. 207]. That calculation (168/40 $\times 2$) is actually 8.4 , before rounding down.

The Plaintiffs rely on these screening levels primarily for their short exposure-duration assumptions. The Plaintiffs argue that if TCE levels rise for even short times, whether due to variability or because a mitigation system fails, a pregnant occupant could be exposed to a risk of developmental defects in the baby, thus presenting an imminent and substantial endangerment. For many of the same reasons already discussed, though, the Court finds the risk of those exposures to be too remote and speculative. Vapor mitigation systems are reliable and effective, and the evidence shows that they are successfully preventing harmful levels of vapors from entering any residences. Speculation that a system could fail, go undetected, and allow vapors to enter in harmful levels (and remain present for three weeks³⁰) falls short of establishing the risk of an imminent endangerment. The Plaintiffs have not shown how quickly or in what amount TCE could enter a home if a system failed, either. Subslab vapor levels have also reduced dramatically and are below screening levels at every residence that was tested in the most recent round. [Jx. 76 p. 6, fig. 3S.2-4]. That indicates that the risk of vapor intrusion is low even if a system failed. Variability is also of less concern in mitigated structures, and the Plaintiffs declined to take samples of their own to test their theory that higher levels of exposure may be occurring, so the Court cannot find that the possibility of variability indicates a risk of harmful exposure, either.

Moreover, the use of the Reference Concentration as a not-to-exceed level for short-term exposures due to the risk of fetal cardiac malformations is questionable. The study on which the Reference Concentration is based in that respect has not been replicated, despite multiple attempts. [Js. 62, p. 6]. IDEM reviewed Region 9's approach and expressly declined to adopt it:

³⁰ The Region 9 and 10 screening levels are based on continuous exposures for three weeks, not one-time or transient exposures. [Px. 169, 207].

“This approach has been highly controversial (the results obtained in the original study indicating increased incidence of fetal cardiac malformations have not been replicated despite several attempts to do so) and has proven to be very problematic as a policy. The majority of states and U.S. EPA regions are not implementing this approach. IDEM has recently concluded that an accelerated response is not scientifically supportable based upon current information.” [Dx. K-1]. The parties’ experts likewise debate the validity of the science underlying this approach.

Even assuming Region 9 and 10’s approach is appropriate for regulatory purposes, though, short-term exposures at or even above that level would not give rise to an imminent and substantial endangerment. As discussed above, the Reference Concentration on which those regions’ levels are based already builds in layers of conservatism and safety margins. [Jx. 14 p. 1-1; Dr. Fedoruk: Jx. 63 p. 20–21; Tr. 767, 771–73, 795–96]. Even exposures above that level within an order of magnitude are thus unlikely to have any appreciable effect.³¹ [Tr. 771–73, 795–96 (Dr. Fedoruk); Dx. K-1 (explaining that IDEM’s action level “is an order of magnitude higher than the indoor air screening level”)]. Likewise, even Dr. Orris acknowledged that exposures in this range are commonplace from background sources. [Tr. 335 (“Q. Is it fair to say that many of us are exposed to TCE vapor levels in excess of 1.9 every day? A. I’m afraid so.”)]. As Dr. Chang testified, “we would be seeing . . . an epidemic of fetal cardiac defects” if those exposures actually created such a risk, but that has not occurred. [Tr. 1171]. Given the unlikelihood that exposures above these levels will occur, as well as the fact that exposures at or

³¹ By comparison, in *Interfaith*, where the court relied largely on exceedances of agency screening levels to determine an endangerment, the contamination (in mediums to which exposure was occurring or threatened) exceeded the applicable levels by 30 to 8,000 times. 399 F.3d at 261.

above these levels would not create a serious health risk even in the most sensitive populations, the Region 9 and 10 levels do not indicate that the contamination here may present an imminent and substantial endangerment.

Finally, Dr. Orris' opinions that there is no safe level of exposure are beside the point. It may well be that less exposure is always better than more, but the question here is whether the contamination may present an imminent and substantial endangerment. The existence of a minute risk comparable to the risk caused by breathing outdoor air with common background levels of toxins, or by ordinary experiences like eating peanut butter or taking a long flight, does not constitute an imminent and substantial endangerment to health. Nor has Dr. Orris otherwise drawn a connection between the contamination here and a serious health risk. Most of his report is devoted to reciting potential effects that TCE exposure can have at some quantity of exposure. But he offers little attention to the circumstances or exposures that give rise to those risks, and he makes very little attempt to connect any of those potential effects to the exposures in question here. [Jx. 59]. To the extent he draws that connection, it is only through his reference to the Inhalation Unit Risk for cancer effects and the Reference Concentration for toxic effects. For the reasons already discussed, the Court does not find that those levels represent thresholds for an imminent and substantial endangerment, and the Court is more persuaded by Johnson Controls' experts' testimony to the contrary. The Court therefore cannot credit Dr. Orris' opinions that the levels of exposure in question here may present an imminent and substantial endangerment to human health.

5. Summary

The Court does not find that the contamination may present an imminent and substantial endangerment to health through the threat of vapor intrusion. An endangerment claim "was designed to provide a remedy that ameliorates present or obviates the risk of future 'imminent'

harms[.]” *Meghrig*, 516 U.S. at 486. Here, the vapor mitigation systems are already doing that, to the extent any risk previously existed. Those systems are effective and reliable and are maintained regularly. With those systems in place, TCE levels have remained well below the levels at which TCE may pose a risk to health, as reflected by regulatory levels as well as by toxicological and epidemiological evidence. The evidence does not show that the contamination may present a risk of vapor intrusion in amounts capable of creating an appreciable risk of serious health effects in unmitigated structures or through preferential pathways, either. And given the preventative steps that have been taken and the remedial activities that have already been implemented, the contamination that remains in the neighborhood and at the site does not create an imminent risk of harmful vapor intrusion in the future, either. Therefore, the Court cannot find that the Plaintiffs have proven that the contamination may present an imminent and substantial endangerment in this respect.

IV. CONCLUSION

For those reasons, the Court concludes that the Plaintiffs have not proven that the contamination may present an imminent and substantial endangerment to health or the environment. The Court therefore finds in Johnson Controls’ favor on the Plaintiffs’ endangerment claim. The Court denies as moot the motions to strike expert testimony. [DE 426, 427, 450, 451]

Because the Court previously granted summary judgment in Johnson Controls’ favor on the Plaintiffs’ other claim, this order resolves this action against Johnson Controls. Defendant Tocon Holdings, LLC, however, is in default and has not participated in this case. Accordingly, the Plaintiffs are ordered to file a status report, by September 9, 2020, as to their claims against Tocon.

SO ORDERED.

ENTERED: August 10, 2020

/s/ JON E. DEGUILIO
Chief Judge
United States District Court